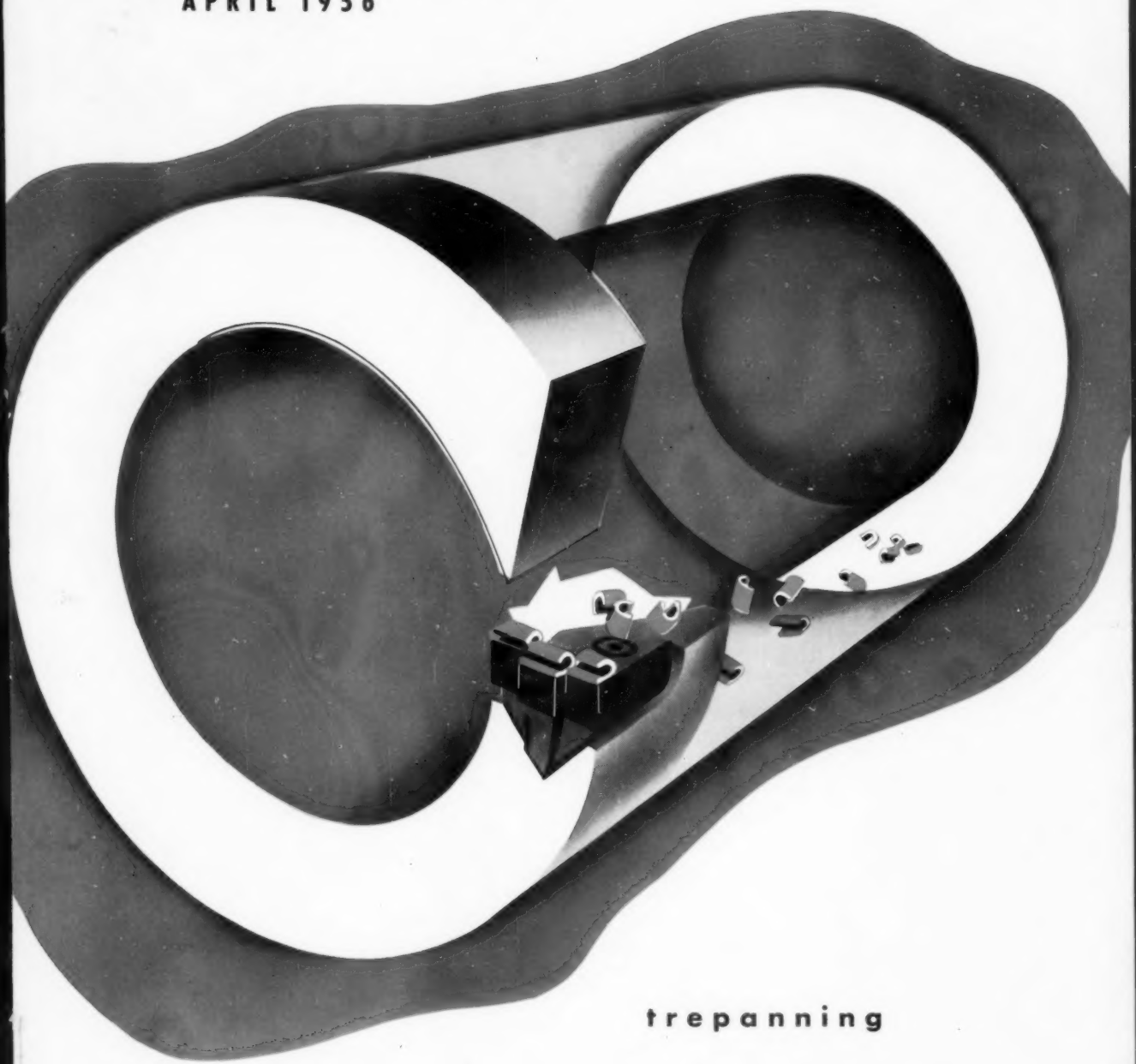
the TOOL ENGINEER

APRIL 1956



trepanning

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS



Exit...

ONE SITTING DUCK

A message of importance to all contestants in the battle against high production costs

PIT A World War II plane against a modern jet fighter and what have you got? One sitting duck! Why? Not because the "prop job" got any *slower*. But because the modern supersonic jet got so much *faster!*

So it is with machine tools. The machine you bought ten years ago may still be working just as good as ever. Yet by today's standards of production speed and economy, that same machine can be *losing money* — perhaps more than a new machine would cost.

This "creeping obsolescence" can often go unnoticed—particularly on small-lot and tool room machines that are not geared directly to a fast-moving automated production line. So take a good look at the old universal Bore-Matics, Rotary Surface Grinders, Tool-Room and Plain Internals in your shop. Check their production and maintenance costs. The results may surprise you.

Your Heald sales engineer will be glad to help you evaluate these machines, fairly and squarely — to show you whether they are earning money for you, or losing it. If you find that you're *paying* for a new machine, you might as well *have* it!

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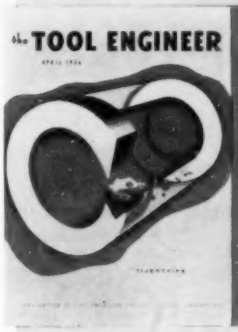
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COVER: Trepanning holes from the solid represents a good production method that is receiving increased attention. Basic trepanning methods can be reversed so the tool rotates, as described starting on page 83, when workpiece shape precludes its rotation.



The Tool Engineer

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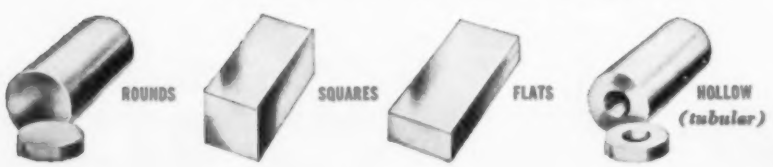
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The Tool Engineer

Black Boxes!

Knowledge of production processes, equipment and materials is increasing more rapidly than the individual tool engineer's ability to assimilate and apply it. The time has come for informational compromises. More and more, the tool engineer will have to concentrate on over-all planning from a broad point of view, leaving to subordinates the task of implementing the plans. Tool engineers should begin to think in terms of "black boxes."

Such a black box represents the complete understanding of what a particular piece of equipment will do in terms of inputs and outputs. Nothing need be known about how the input is turned into the desirable output. Internals of the black box may be gears, belts and pulleys, electrical circuits, vacuum tubes or a source of nuclear energy. If the input and output characteristics are known, the unit can be correctly applied. Successful application requires details on the anticipated service life and necessary maintenance schedules under specific conditions of use.

An electric motor represents a simple black box. Motors can be correctly applied when connected to a power source that matches the motor requirements for voltage, current and phase. Output for the motor is known in terms of speed, torque, temperature rise and starting characteristics. To specify a motor for a particular operation, it is not necessary to know about resistance and windage losses within it, type of armature winding, internal materials of construction or design features. As units become more complex, it becomes more necessary to think of them as black boxes.

As the tool engineer leads the way toward automatic production, he will come more and more into contact with electronic control devices. He will be able to apply them if he knows what stimuli are required to operate such devices and what control can be achieved by them.

Naturally, the more that is known about a particular production unit, the wider can be its correct application. However, if tool engineers can prepare specifications in terms of black boxes, experts will be available to fill the boxes.

Robert A. Wason
ASSOCIATE EDITOR

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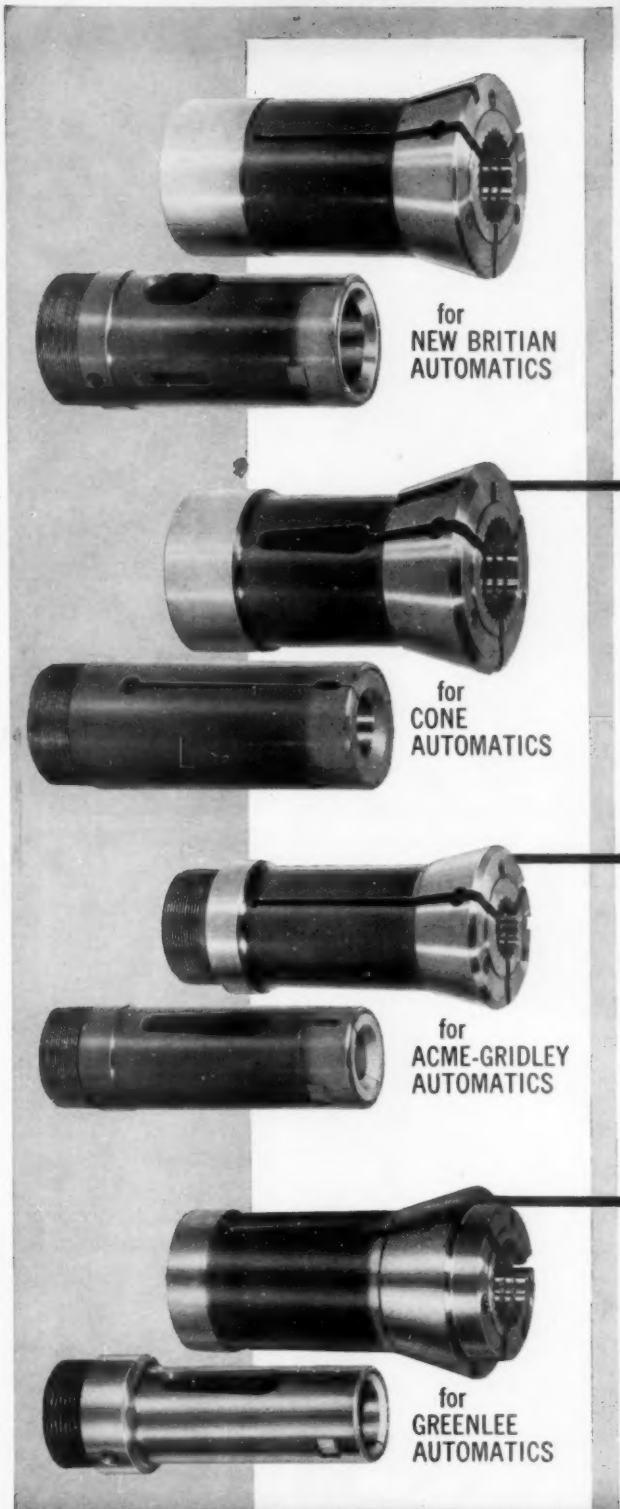
2. Master is rotated to proper position for use.



3. Bore gage is set to master after V-block is adjusted to centralizing plungers.

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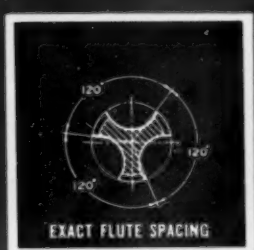
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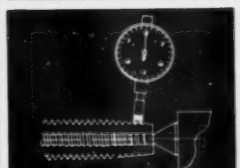
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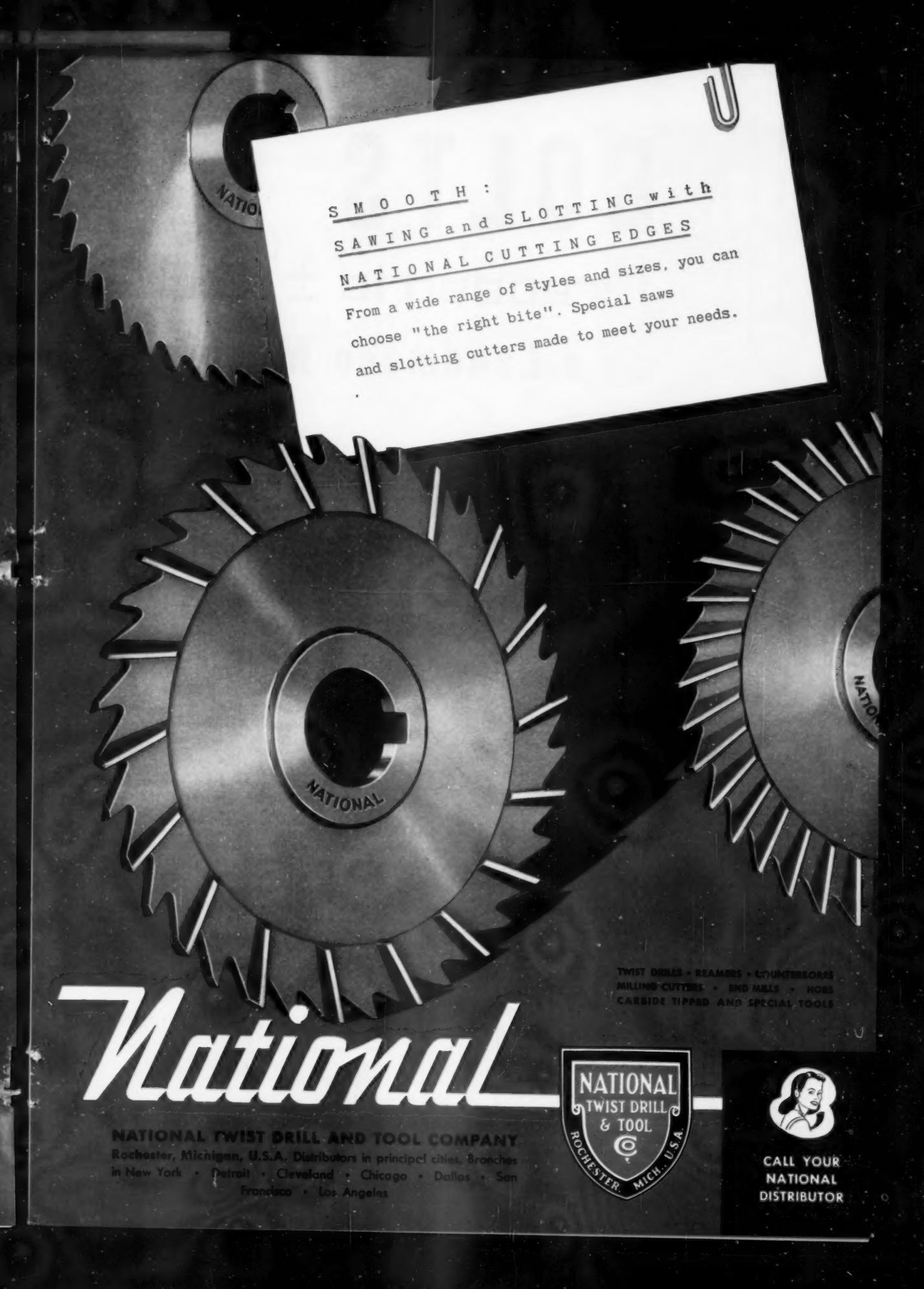
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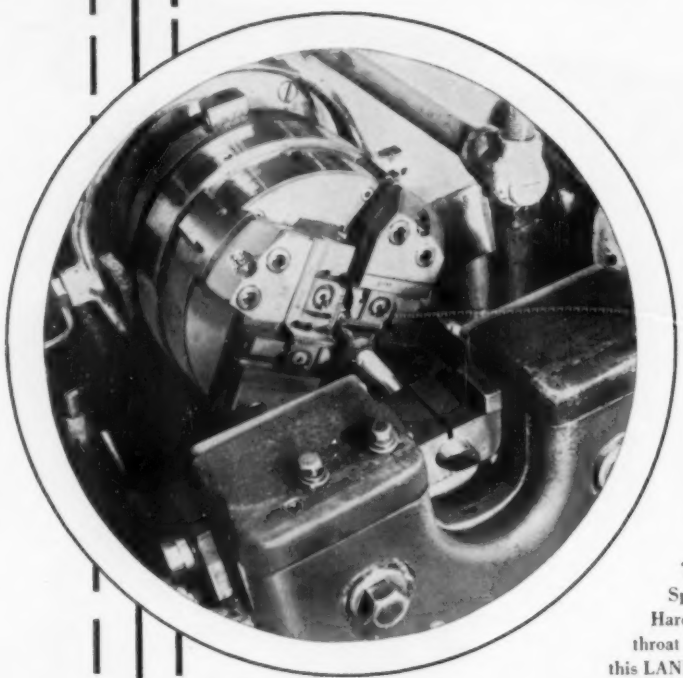
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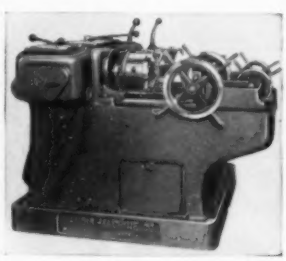
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This installation illustrates the production advantages of LANDIS Equipment for difficult and exacting threading operations. The mechanically-controlled positive feed of the Leadscrew, the maximum rigidity of Die Heads designed for precision threading, and Chasers of special specifications—allow threading hard material with minimum cutting strain. As a result, threads are produced to close tolerances at economical production rates and low tool cost.



For further information, ask for Bulletins H-75 (LANDMACO Machines) and F-80 (Hardened and Ground Heads). Please send specifications when writing.

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367

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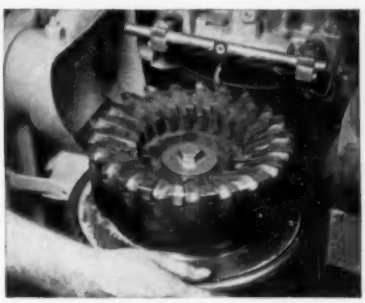
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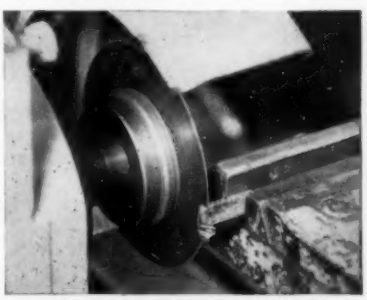
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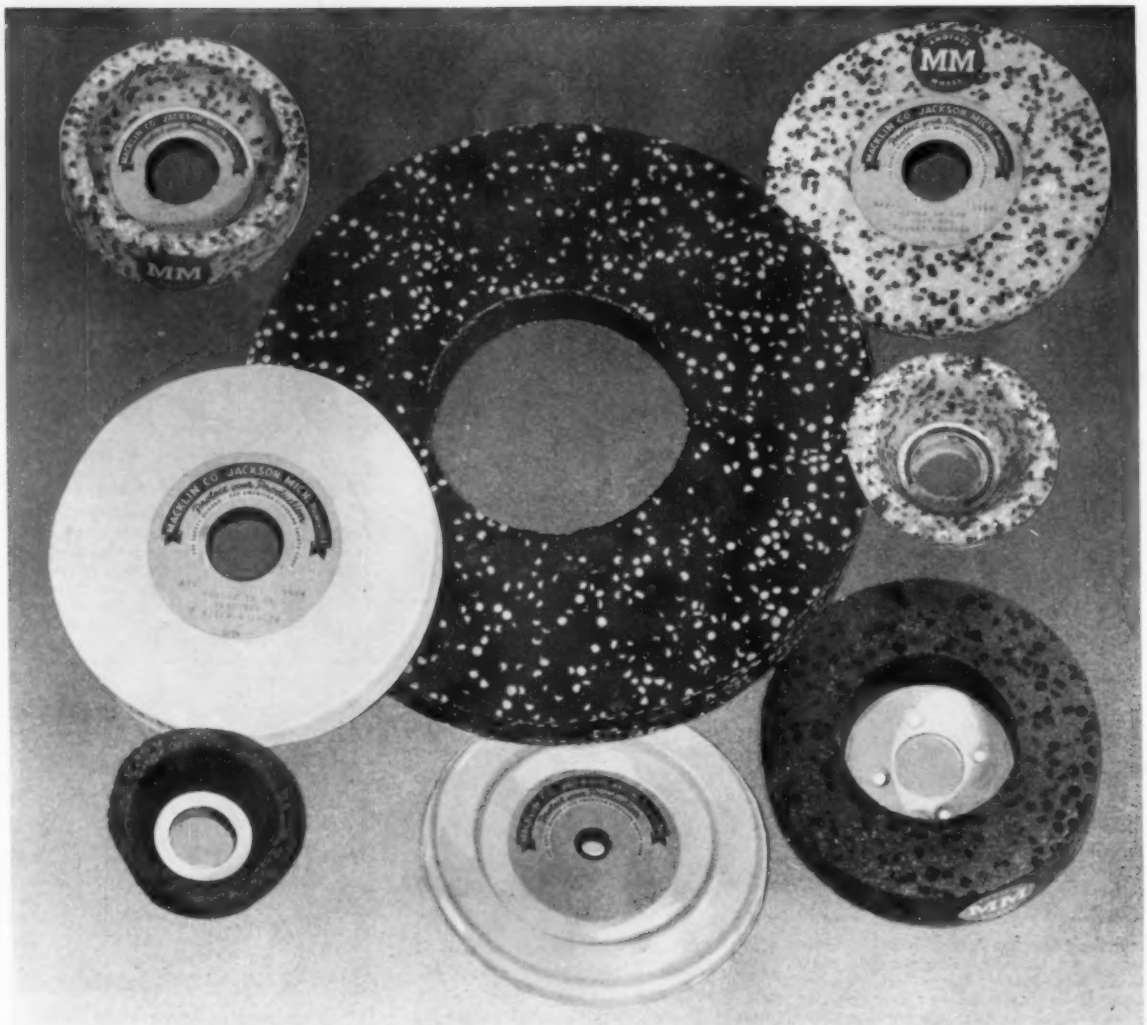
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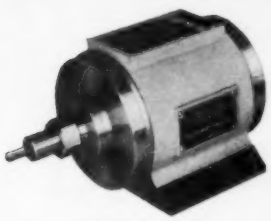
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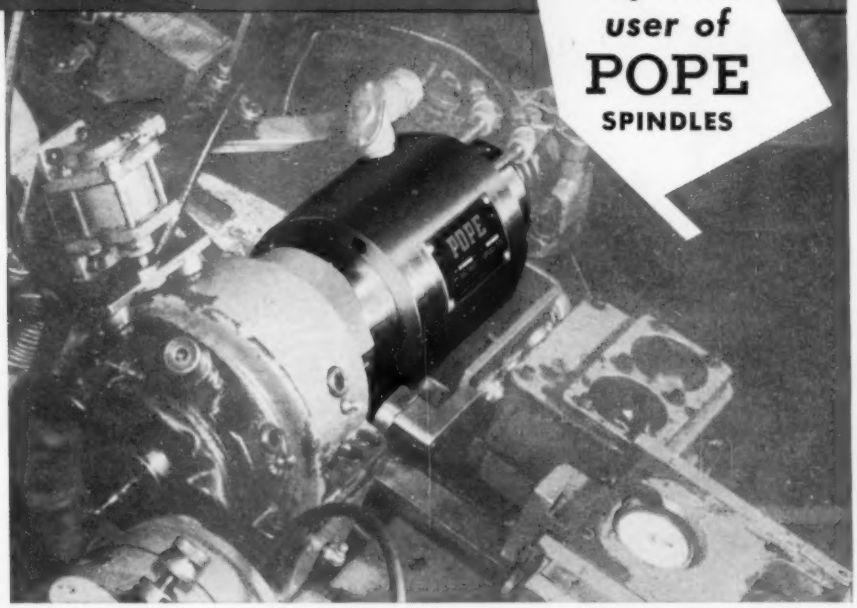
You can disassemble, replace the bearings, reassemble and get this spindle back into operation in less than one hour, without removing the spindle housing from its set-up position — another cost-saving feature of Pope Hi-Cycle Spindles.

This rugged, long-lived Pope Spindle has the rigidity, both radially and axially, for *continuous* production of *accurate* parts. Spindles of similar design available for higher speeds.



THESE ARE THE
BEARINGS

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THE FAFNIR BEARING COMPANY operates POPE Heavy Duty, 72,000 RPM Hi-Frequency Wheelheads on No. 1 Landis Grinders for extra precision ball bearing race grinding.

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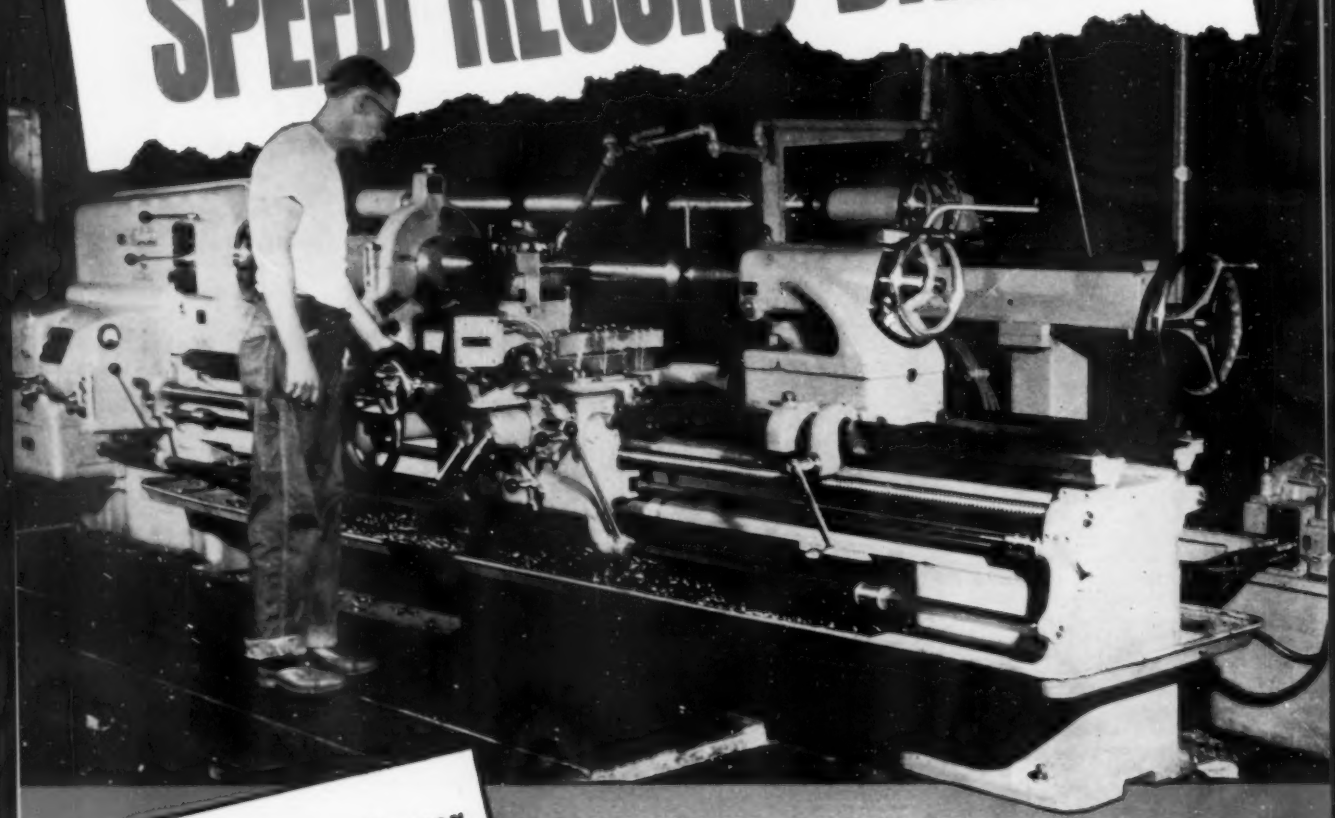
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No. 109

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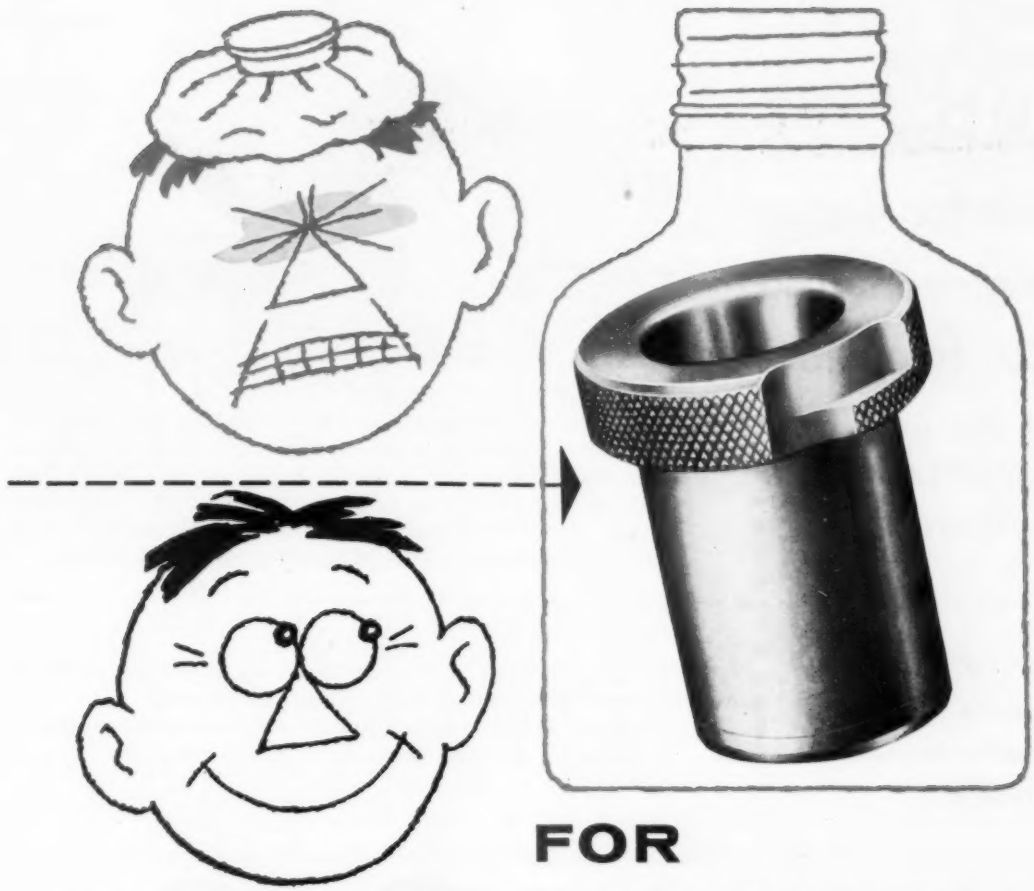
Note particularly that a finish turned motor shaft is used for a template, showing the rugged stability of "AMERICAN" Template Supports.

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MULTI-FLEX PRODUCTS ARE CIRCUMFERENTIALLY CORRUGATED!

This gives flexibility, rigidity, and the ability to take movements in axial extension and compression. Other qualities are:
• Resistance to crushing and fatigue • Resistance to extremes of temperatures, abrasives, corrosives, oil, water, and grease • High travel ratio.

WHAT ARE SOME EXAMPLES OF MULTI-FLEX PRODUCTS?



Above are shown only six of the various styles of U.S. Multi-Flex boots. Because Multi-Flex boots are custom-made, THEY CAN BE "TAILORED" TO MEET THE EXTENSION, COMPRESSION AND DESIGN REQUIREMENTS OF ALMOST ANY APPLICATION.

WIDE APPLICATION FOR MULTI-FLEX!

In industry: Multi-Flex boots are used for rams in hydraulic presses making grinding wheels or other abrasive materials; on adjusting screws in grinders and machine tools; for guide rods in mechanical stamping presses; for reciprocating parts and for pistons and worm gears in a multitude of applications; for any hydraulic cylinders and other reciprocating parts requiring protection.

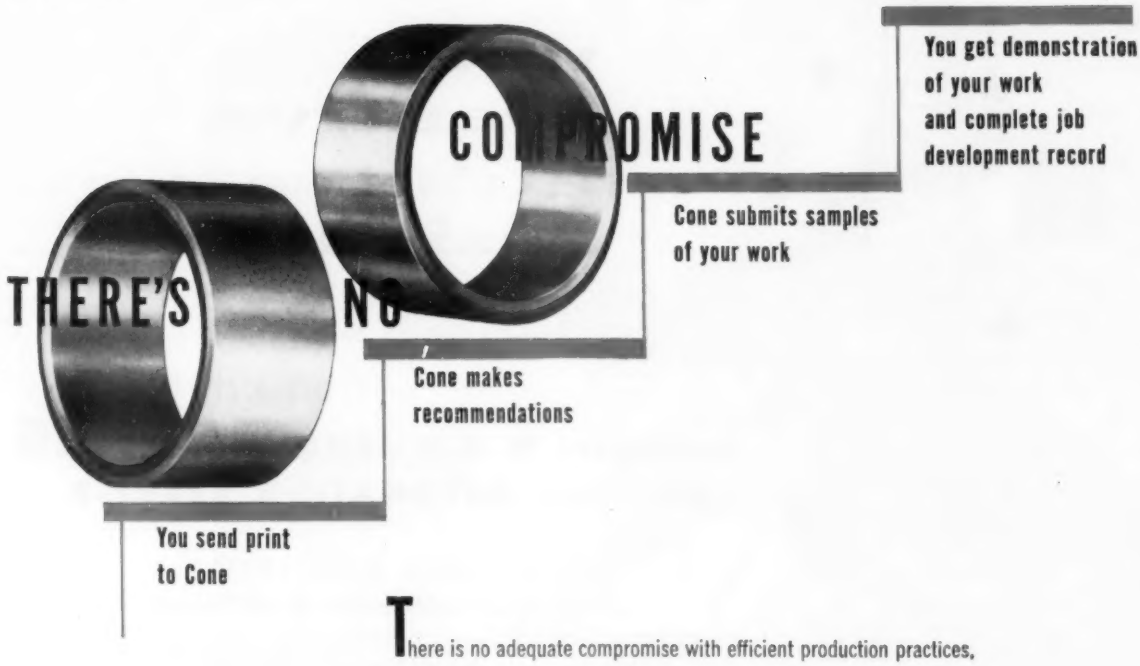
Any maker of equipment with moving parts which need protection should investigate U. S. Multi-Flex®. For engineering advice, get in touch with any of our 27 District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

US RUBBER

Mechanical Goods Division

United States Rubber

No. 6 in a series



There is no adequate compromise with efficient production practices, if you are in business for a profit.

But you don't always know just how competitively efficient your equipment is. Case histories of what the other fellow is doing are sometimes garbled. At least the poor ones are not advertised. And conditions vary in all plants. Sometimes you have reason to be more concerned with what you don't want in new equipment than with what you do want. Cone believes too much is at stake for a machine to go into a line unequipped for the job, with either carbide or hss tools.

The Conomatic Carbide Development treats each job individually from standpoint of work, machine, tools, and operating personnel.

DATA FOR COMPARISON

Part.....Bushing	Length.....⅝"
Machine.....1⅝" Conomatic	Hole Dia.....1¼"
Tools.....100% Carbide Tipped	RPM.....825
Material.....8620	Time.....14.8 Secs.
Stock Size.....1⅝"	

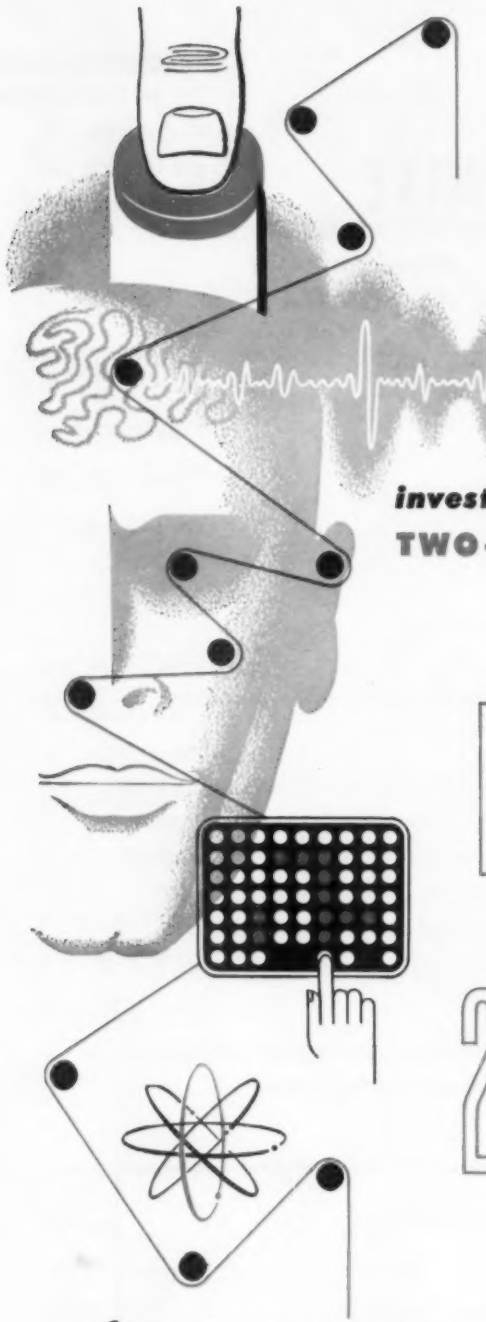


Conomatic

For particulars send for "Four Steps With Cone"

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-15



need creative automation assistance?

investigate W. F. & JOHN BARNES TWO-FOLD AUTOMATION SERVICE

1 ENGINEERING COMPLETE PRODUCTION-LINE SYSTEMS

Complete service includes planning step-by-step sequence of operations and the individual engineering of processes, methods and equipment to meet your production needs. Barnes' creative engineering, developed over a period of 80 years in designing and building high production machine tools, can be depended upon to provide you with the latest in cost-cutting methods. Our highly versatile engineering staff will work with you as a team to solve problems quickly and efficiently.

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To meet specific work-handling or processing needs, Barnes' engineers have designed and built special conveyors, turn-over mechanisms, inspection, and assembling equipment to suit either automatic or semi-automatic requirements. Hundreds of units are today profitably serving a wide range of industries. Because electrical, hydraulic, mechanical, tool and fixture engineering is closely coordinated at Barnes under one roof, you save time and eliminate divided responsibility.

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Ask for Production Analysis

Find out today why more and more production executives are turning to Barnes for help with their automation problems. Barnes' creative engineering staff will be pleased to analyze your requirements, offer recommendations, and provide you with a cost estimate in a formal proposal, if you desire.

Builders of Better Machines and Equipment since 1872

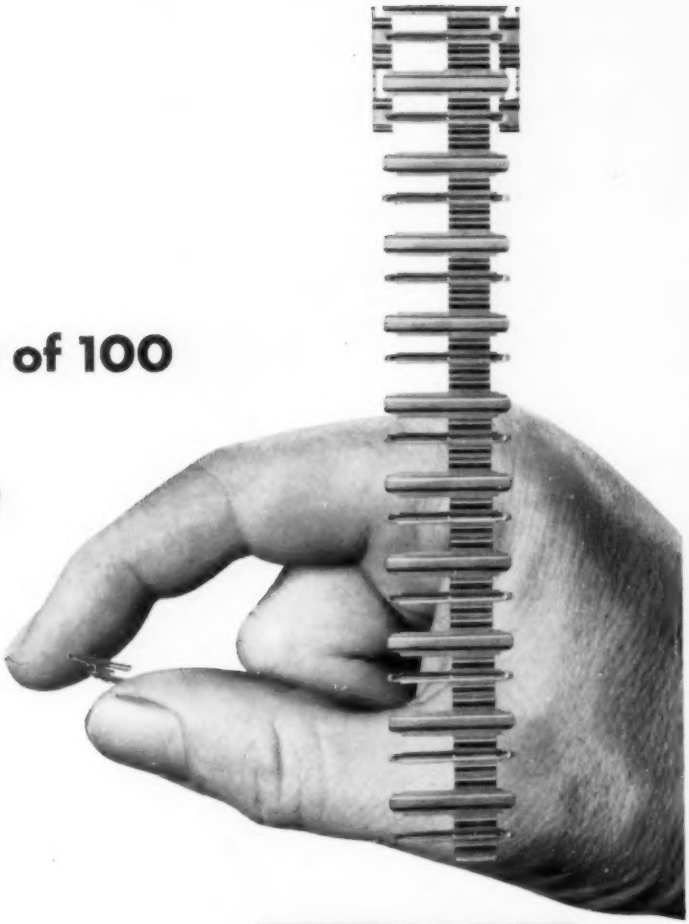
W. F. & JOHN BARNES

AUTOMATION SECTION

431 S. WATER ST. • ROCKFORD, ILLINOIS

SPECIAL MULTIPLE SPINDLE MACHINE TOOLS • SPECIAL PROCESS EQUIPMENT • SPECIAL ELECTRICAL CONTROLS

Chances are **98 out of 100** that this part will be **perfect**



The Metal Parts Division, Sylvania Electric Products, Inc., keeps rejects under 2%—even on complex, close-tolerance parts produced at rates to 9,000 per hour. Optical gaging helps set this level.

The diode plate shown above is an example of the complex, mass-produced, parts turned out to close tolerances by Sylvania's Metal Parts Division at York, Pennsylvania. Tolerances run to ± .002"; as many as 10 dimensions must be held, including inner and outer diameters. Yet even on parts more difficult than this—parts with tolerances of .0005" and forming rates of 9,000 per hour—Sylvania gets an acceptance rate of over 98%.

Inspection on Kodak Contour Projectors helps Sylvania do the job to the satisfaction of its customers, both internal and external. Operators check the first parts produced by every machine to assure correct setup. Then, throughout the run, production samples are checked at regular intervals—making certain each machine is holding to tolerance. The speed with which these parts can be checked using optical gaging methods has helped slash rejection rates more than 50% since Kodak Contour Projectors were installed.

If you have difficult inspection problems involving quantity, speed, close tolerances or hard-to-measure dimensions like shoulders, holes, radii or angles, there's every reason to expect a solution by optical gaging on a Kodak Contour Projector. There's a representative in your area who can tell you more. To get in touch with him, or for a copy of the booklet, "Projection Gaging with Kodak Contour Projectors," write Special Products Sales Division.



Little training is required to operate a Kodak Contour Projector. Operators sit comfortably in a fully lighted room. The work gets out in a hurry.

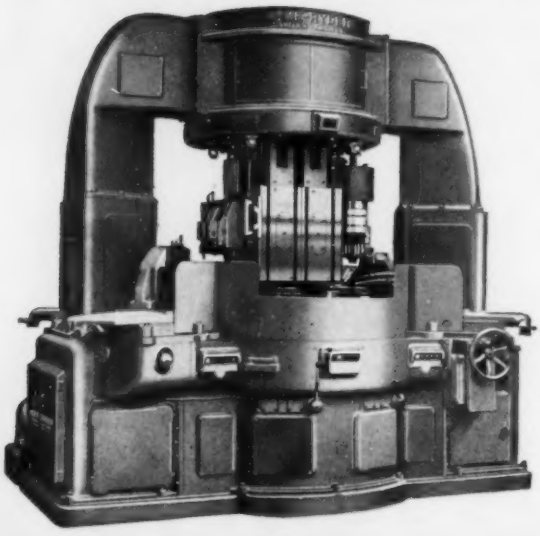
EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE-MARK

14" ACME

8-SPINDLE VERTICAL HYDRAULIC



OFFERS MORE

of what you need in a Vertical Chucker

- ★ Sturdy arch frame and massive base construction provides rigid support for top housing and vertical toolslide column.
- ★ Four independently-operated cross slides.
- ★ Feed control of all toolslides by positive cam control.
- ★ Eight vertical toolslides for end-working tools and attachments.
- ★ Wide range of feeds and spindle speeds, with 3-speed selectivity at each work station.
- ★ Operating controls conveniently located at front and rear of machine.

THE NATIONAL ACME COMPANY

170 EAST 131ST STREET • CLEVELAND 8, OHIO

RYDER

CHUCKING AUTOMATIC

Introduced by

NATIONAL ACME

also built in 6-spindle, 17-inch capacity

in response to today's **NEED** *for* **SPEED**

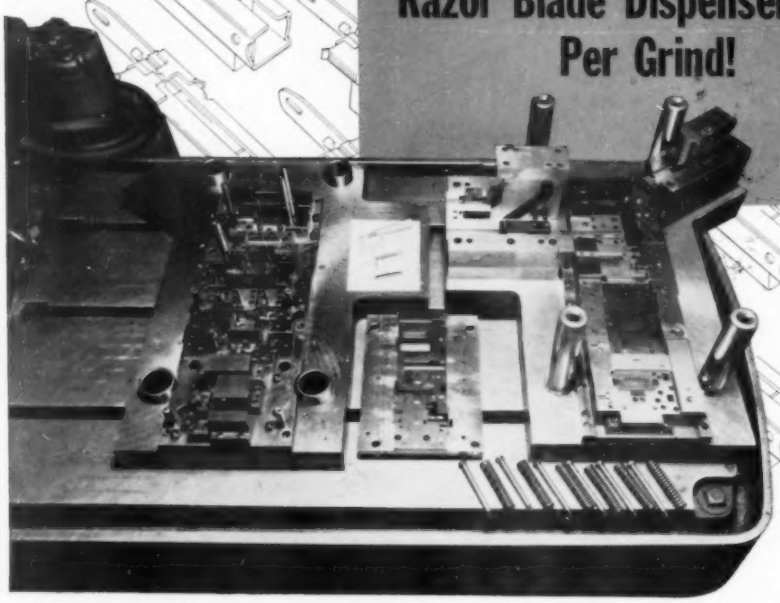


LUDLUM DIE STEELS

PUNCH, STAMP, FORM

2 MILLION

Razor Blade Dispenser Parts Per Grind!

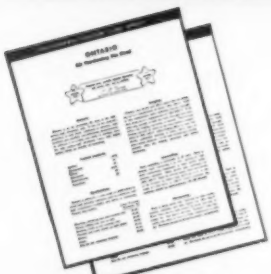


Punching, stamping and forming parts of this die are of air-hardening Ludlum ONTARIO—heat treated to 61-62 Rockwell C. Slides, frames and cams are of Ludlum DEWARD oil-hardening die steel—heat treated to 61-62 Rockwell C.

Ontario sections were pre-heated to 1250 F, then heated to 1850 F, held at 1850 F for about an hour and a half, then quenched in still air to room temperature. Finally they were drawn at 350 F for about three hours.

Deward sections (slides, frames and cams), were pre-heated to about 1200 F, then raised to 1420 F. As soon as they were uniformly heated and equalized with the furnace temperature, they were quenched in warm oil. Sections were then tempered for two hours at 325 F.

Thus, two superior Ludlum steels combine to solve an intricate production problem. You, too, may have an application that will benefit from a better selection of tool or die steels. For complete information, call your nearest A-L distributor or representative today, or write *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh, Pennsylvania.*



Write for your

DEWARD & ONTARIO BLUE SHEETS

These 4-page folders contain complete information on forging, annealing, tempering, etc., and detailed laboratory data on physical characteristics of Ludlum Deward and Ontario. *Ask for your free copy.*

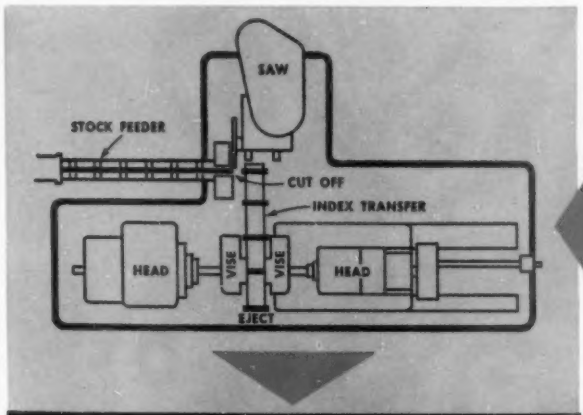
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WAD 8351

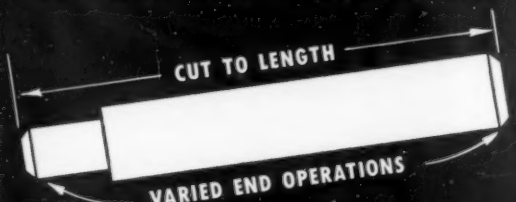
AL® FINE TOOL STEELS SINCE 1854



HOT BED OF ACTIVITY

Motch & Merryweather's new transfer machine widens the horizon for the simultaneous double-end machining of bar stock or tubing. Combined with cut-off to accurate length are: centering, chamfering, turning, drilling, or boring. Box mill turning is performed along with center drilling and chamfering. From stock pile to discharge, all operations can be fully automated. For the quickest answer to speed your stock processing, send us your part drawing.

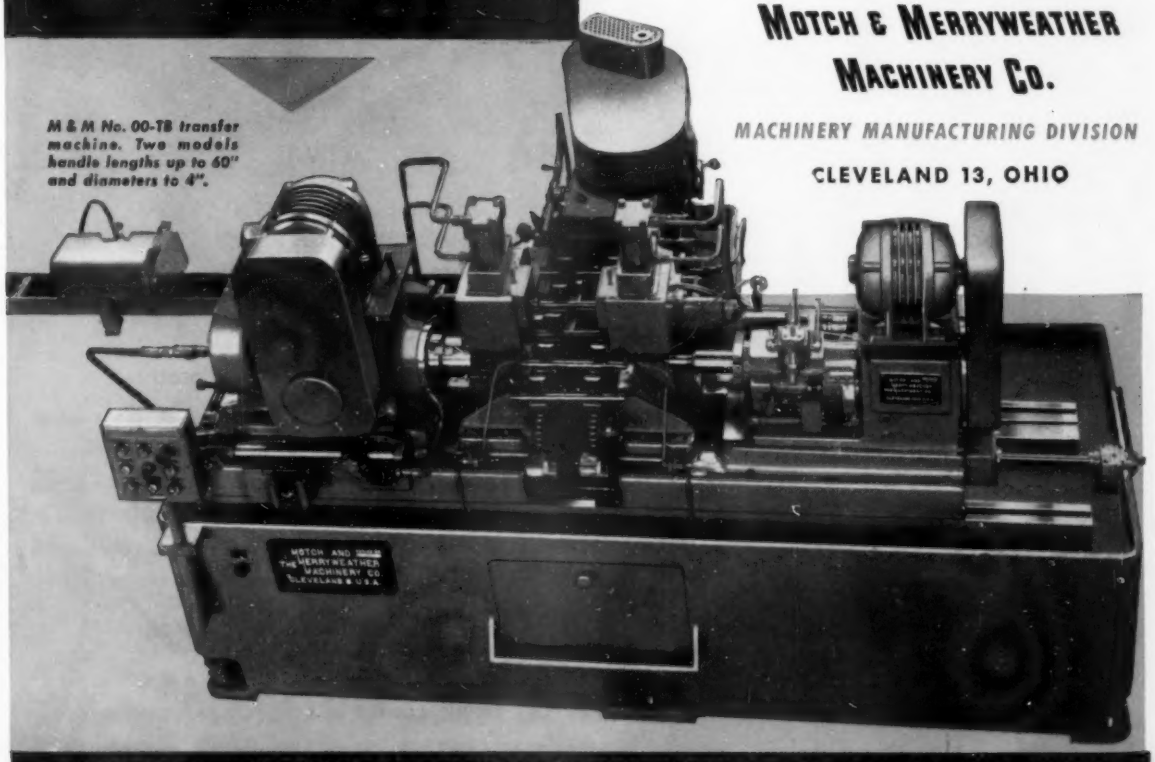
Simultaneous
STOCK CUT OFF and DOUBLE END MACHINING



THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO



M & M No. 00-TB transfer machine. Two models handle lengths up to 60" and diameters to 4".

BUILDERS OF AUTOMATIC PRECISION CUT-OFF, MILLING, AND SPECIAL MACHINERY

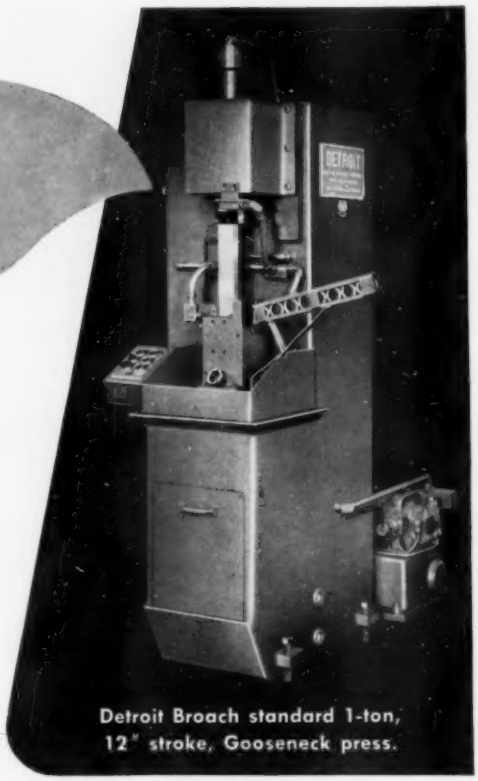
STANDARD DETROIT PRESS

broaches oil groove in

700 BEARING RACES/Hr.

This application shows the versatility of Detroit Broach standard presses. Tooled for automation, parts are magazine fed from the preceding operation, broached and then dropped into a tote basket ***without an operator.*** Parts can also be chute-fed to next operation.

An important advantage of this type of automation lies in the fact that if the operation should be obsoleted, this standard press can be applied, without change, to another operation.



Detroit Broach standard 1-ton, 12" stroke, Gooseneck press.



Detroit Broach standard 10-ton, 30" stroke, Side Plate press.

STANDARD DETROIT PRESSES

for BROACHING ★ ASSEMBLING ★ STRAIGHTENING

- ★ Complete range of sizes and strokes in both Gooseneck and Side Plate presses.
- ★ Sensitive, positive control of ram speed, force, travel and direction of movement.
- ★ Rigid construction with compact, fully-enclosed operating mechanism.
- ★ Simple manual, semi-automatic or fully automatic control.
- ★ Powered by dependable Oilgear fluid power system.

Detroit Broach COMPANY

ROCHESTER, MICHIGAN

OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD



ECONOMY

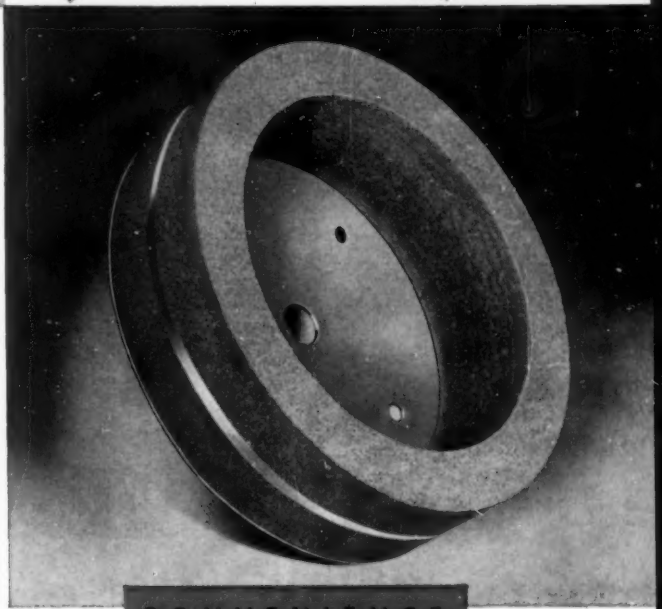
two efficient ways

to solve the same problem !



STERLING EASYMOUNT and PLATE MOUNTED WHEELS

provide equal winning performance for carbide tool grinding



CONVENIENCE

● For faster, expert carbide tool grinding, folks find record-breaking performance every time from the Sterling Twins—the Easymount or Plate-Mounted Wheel.

You cannot go wrong on either choice of abrasive tools. Many choose the Easymount for economy and others like the Plate-Mounted Wheel for its convenience. Both provide economical, more precise grinding of carbides every time.

Ask for a trial of either the Easymount or Plate-Mounted Wheel—or both! Sterling engineers will gladly show you how quickly either Sterling unit pays for itself.

"THE WHEELS OF INDUSTRY" STERLING ABRASIVES

STERLING GRINDING WHEEL CO., TIFFIN, OHIO

A SUBSIDIARY OF

ABRASIVE AND METAL PRODUCTS CO.

A&MP COMPANY

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it's easy to recognize the
PRODUCTION VERSATILITY

of this **LAPOINTE**
electro-motive drive

As shown in these photographs, this double ram machine is broaching stator wheels on the left side and mating blades on the right. Here's balanced production!

However, it could be set up for broaching *all wheels, or all blades — or other comparable parts.* With Lapointe-built broaching fixtures, you can quickly make a change-over to suit your production requirements of the moment.

And we do mean production, for this 40 hp., 100-inch stroke machine broaches at rocket-like speeds up to 300 feet-per-minute! Built for operating right around the clock, 24 hours a day, this heavy duty Lapointe Broaching Machine with electro-motive drive was purposely engineered for mass production.

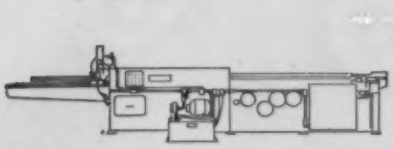
Any questions? We probably have the answers . . . we've been building broaching equipment exclusively for 54 years — longer than anybody else!

THE LAPOINTE MACHINE TOOL COMPANY

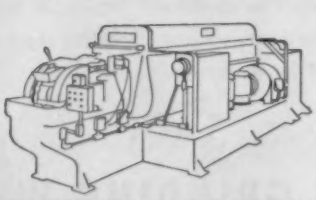
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

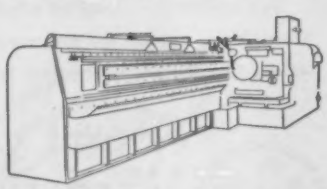
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



60" STROKE HORIZONTAL, ELECTRIC

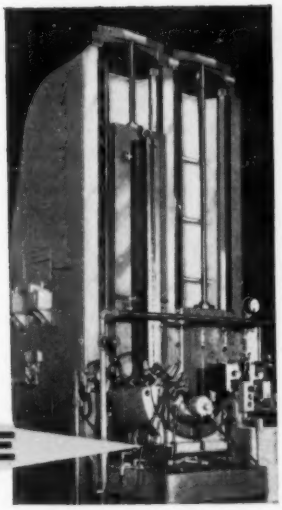


CH CONTINUOUS BROACHING, ELECTRIC



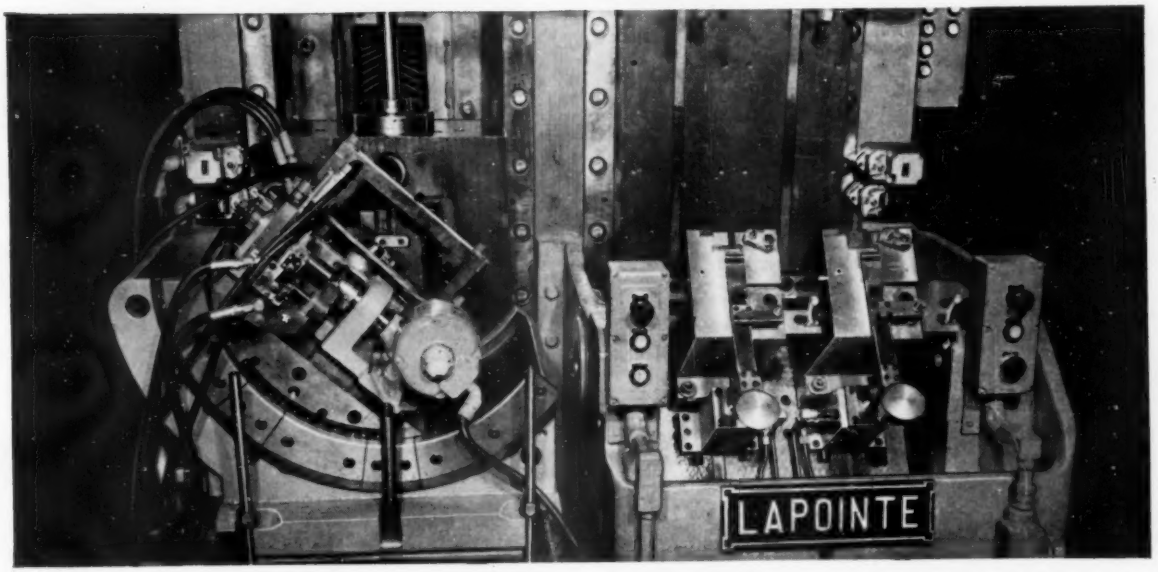
SRHE SINGLE RAM HORIZONTAL, ELECTRIC

BROACHING MACHINE

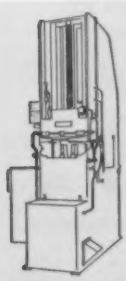


This machine weighs 68,000 pounds. A comparable machine with hydraulic drive weighs only 38,000 pounds. Weight is a most important factor in a broaching machine built for electro-motive drive, as Lapointe has learned through years of pioneering experience in developing electro-mechanical broaching machines.

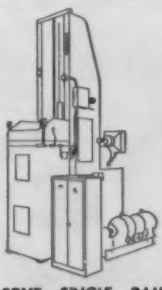
LAPOINTE takes all the responsibility, for your broaching program — we build the broaching *machines,* build the broaching *fixtures,* and make the *broaches!*



Fixture on the right ram is the patented Lapointe Tip-Down type. The universal fixture on the left ram can be set from 0° to 45° rotatively, and 0° to 30° conically, enabling parts to be processed at a compound angle. Here, it is broaching stator wheel slots . . . 76 of them, equally spaced within .005" of true position.



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

BROACHING MACHINES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-25

From the World's Most Complete Line . . . your MORSE-FRANCHISED DISTRIBUTOR can recommend the correct cutting tool for every job in your plant . . . regardless of tool requirements



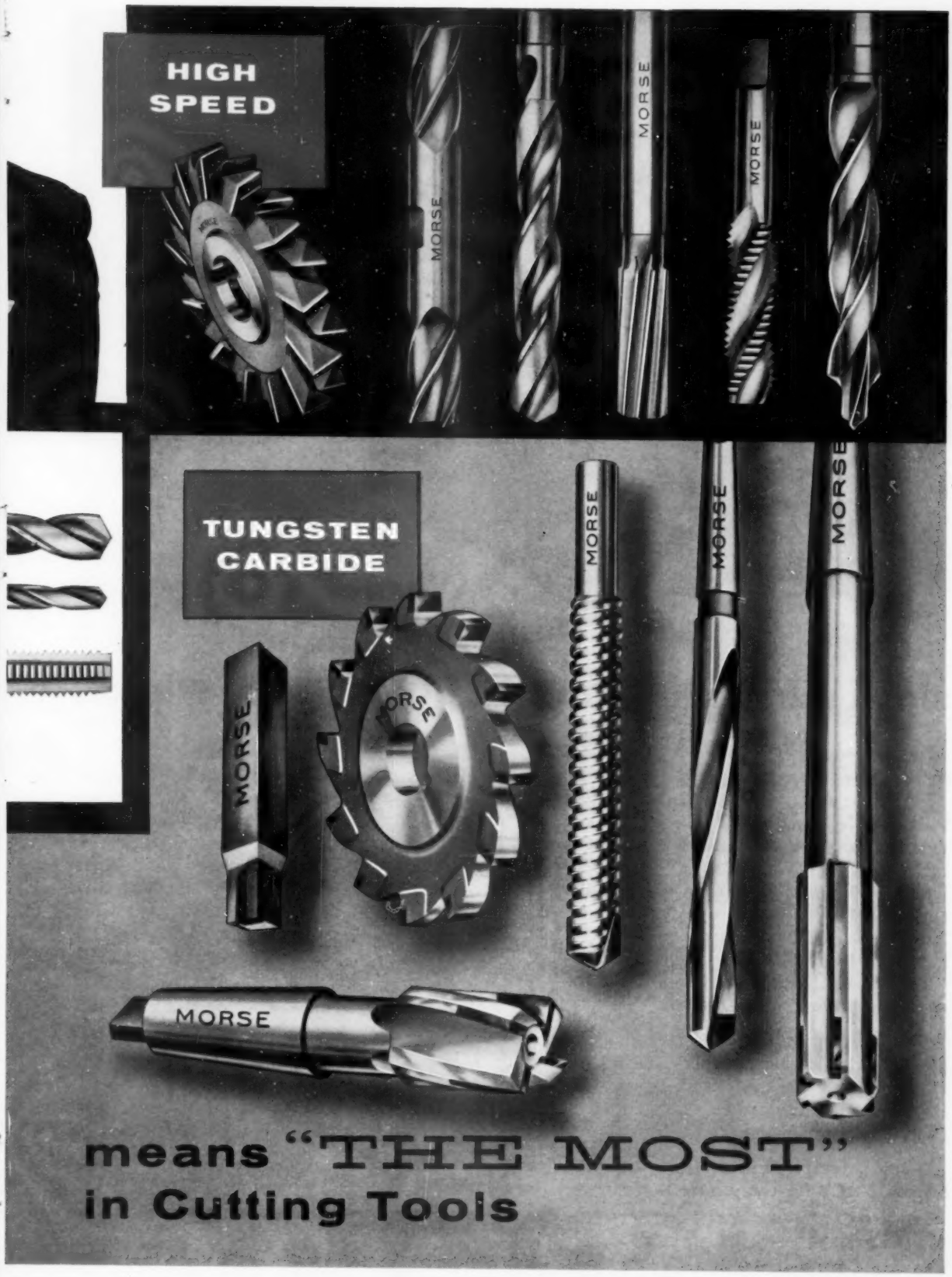
There's the whole Morse story right there in a nutshell. And it simply means that whatever you need for any job . . . carbon, high-speed or tungsten carbide, you can get it from your Morse-Franchised Distributor.

What's more, it means that Morse can give you, consistently, the lowest cost-per-cut you ever experienced. That's why it always pays to call your Morse-Franchised Distributor . . . because he's the one man who can give you "The Most" in cutting tools . . . and that means nobody (*but nobody*) but Morse! *Call him now.*

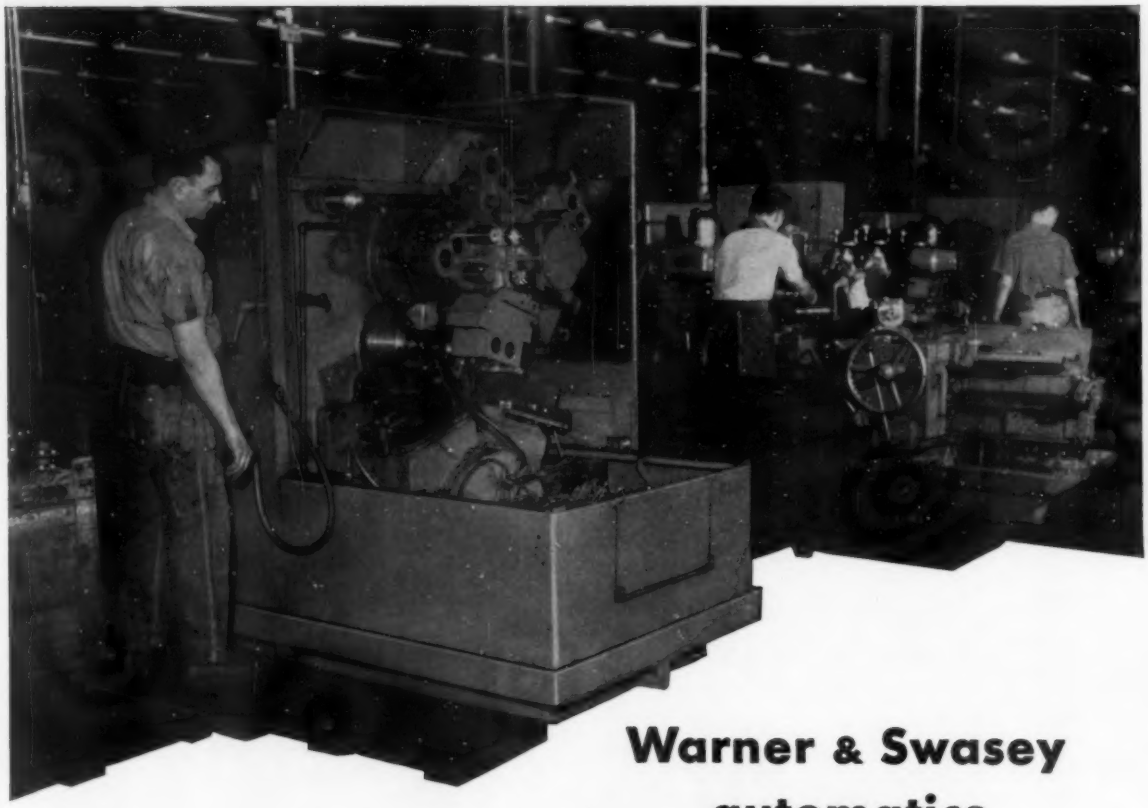
MORSE TWIST DRILL & MACHINE COMPANY
New Bedford, Massachusetts
Subsidiary of VAN NORMAN INDUSTRIES, INC.
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco

that's why MORSE

Buy them by phone from your Morse-Franchised Distributor and save ordering time



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-27



Warner & Swasey automatics slash machining time on 50 to 350 piece lots

THE YALE & TOWNE MANUFACTURING COMPANY, Philadelphia, machine 64,000 different parts, on a two-month cycle, for their five models of industrial lift trucks. They installed two Warner & Swasey 2 AC Single Spindle Automatics to step up production on a wide variety of small lot parts. Lot sizes range from 50 to 350 pieces.

They quickly realized the expected production increase, plus more efficient use of manpower, since one operator can easily handle both automatics.

They selected Warner & Swasey 2 AC's for the job because these machines give them the advantage of automatic production *without* the usual penalties of greatly increased setup time. Their setup time is just a small fraction more than on turret lathes.

"Another big advantage we had not fully anticipated," they report, "is the interchangeability of tools. The very accessible tooling area and the use of many standard turret lathe tools are valuable features of these automatics."

There are undoubtedly many small lot, "turret lathe" jobs in your own plant that could be machined faster, more profitably and with extreme accuracy on Warner & Swasey Single Spindle Automatics. Have your Warner & Swasey Field Representative show you how these machines' flexibility and fast setup can pay off for you.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY



now...

VALUABLE DIE-SET DATA FOR ALL TOOL ENGINEERS

It's easy-to-look-at! More than 200 pages are specially edited and arranged for quick and simple reference. Full color is used to make tables easier to read, illustrations more clear. The easy-to-look-at format plainly indicates all optional features. Covering the complete Danly "Leadership Line", this catalog presents full dimensional data and specifications for all Danly Die-Sets, Diemakers' Supplies, Bolster Plates and Bolster Plate Accessories. Get your copy of this new easy-to-look-at Danly catalog. *Write for it today.*

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MORE COMPLETE DESIGN INFORMATION

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DIEMAKERS' SUPPLIES

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DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Ave., Dept. D, Chicago 50, Ill.



THE BEST THAT MONEY CAN BUY!



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The CARD Quality

Presenting the Symbol of Service

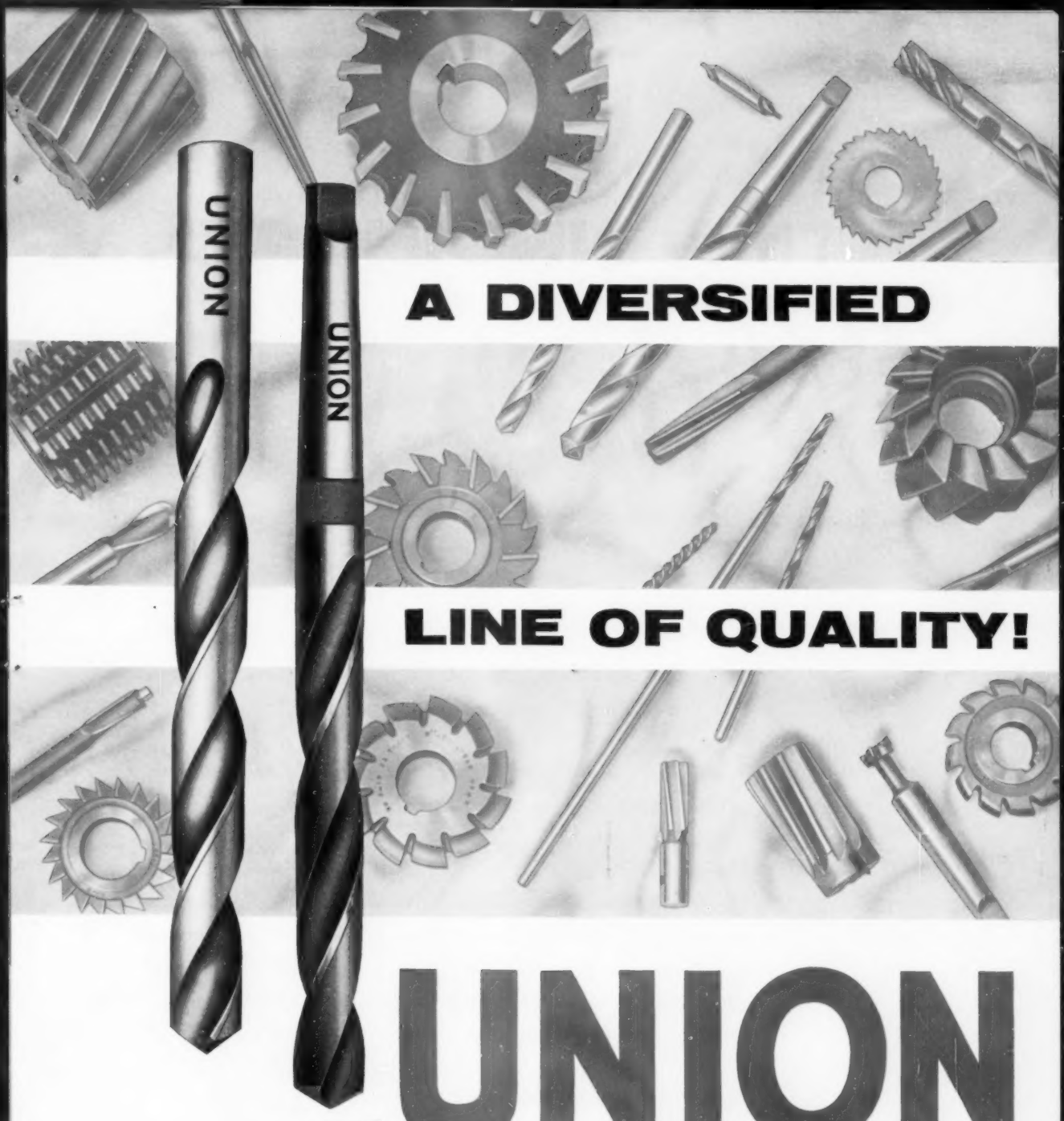
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Card Taps and Gages are your best buy because quality, accuracy and long life are built in by Card, famous for over 80 years of precision tool manufacture. Always specify Taps and Gages by Card.

S. W. CARD MANUFACTURING COMPANY • MANSFIELD, MASSACHUSETTS
Division of: UNION TWIST DRILL COMPANY

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A DIVERSIFIED LINE OF QUALITY!

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Call Your
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for
Prompt, Dependable Service

In every drilling operation there's a particular drill that will do the job for you quickly, accurately and economically.

Union offers a complete selection of top quality drills, standard and special, to suit the requirements of your job.

UNION TWIST DRILL COMPANY • ATHOL, MASSACHUSETTS

Owners and Operators of: S. W. CARD DIVISION, Mansfield, Mass.
BUTTERFIELD DIVISION, Derby Line, Vermont and Rock Island, Quebec

This CINCINNATI...

1½" thick x 12'

This 15012 Series Cincinnati All-Steel Shear has a 36" gap and a 48" back gauge range.

Power for heavy cutting with accuracy and operating convenience are combined in this machine.

Modern features such as—Hydraulic Holddowns, Front Operated Power Back Gauge, Hinged Back Gauge Angle, Automatic Pressure Lubrication, All-Steel Interlocked Construction, Forged Alloy Steel Eccentric Shaft—all contribute to an outstanding performance with low maintenance and high accuracy.

Write for Catalog S-7.

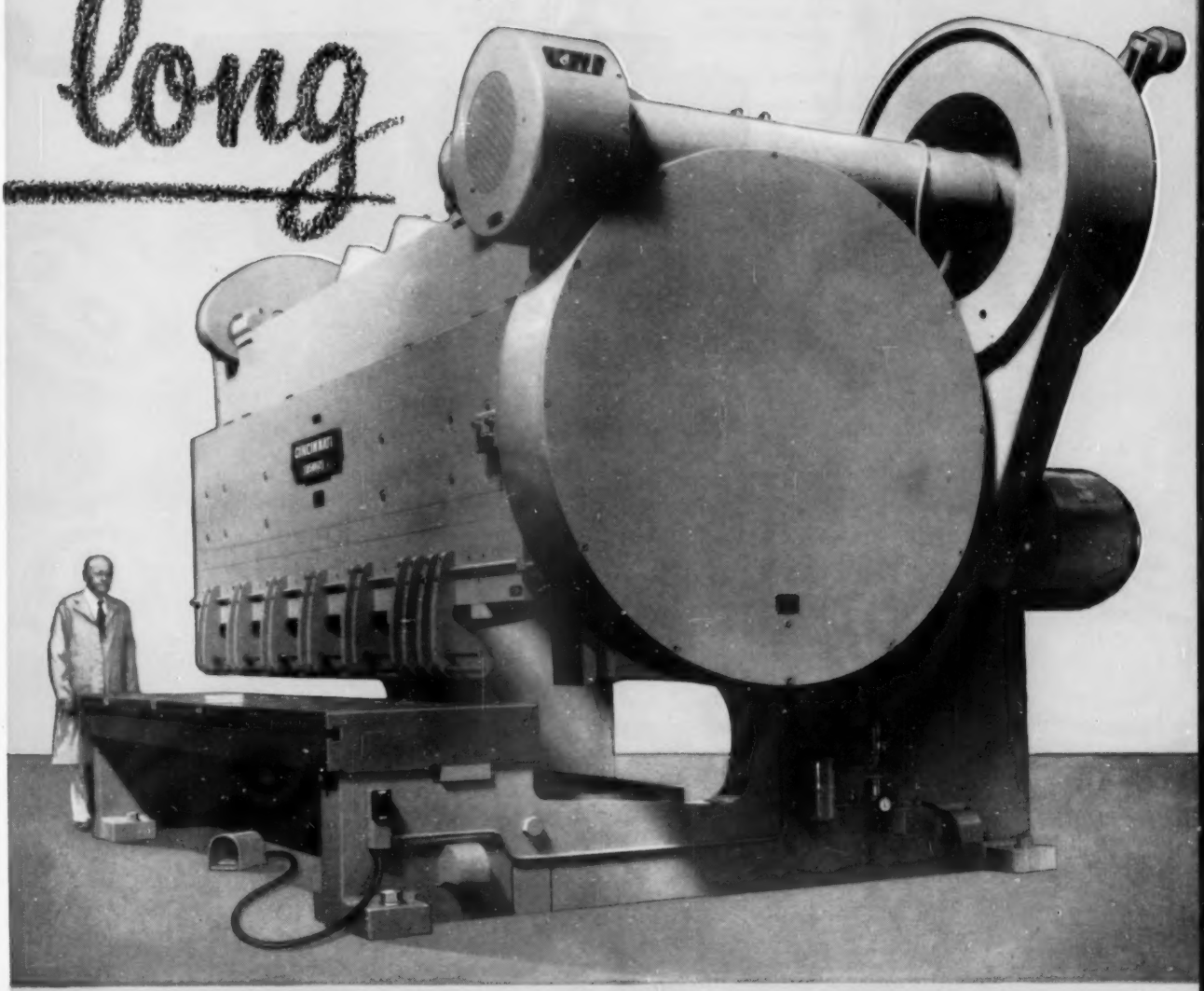


THE CINCINNATI SHAPER CO.

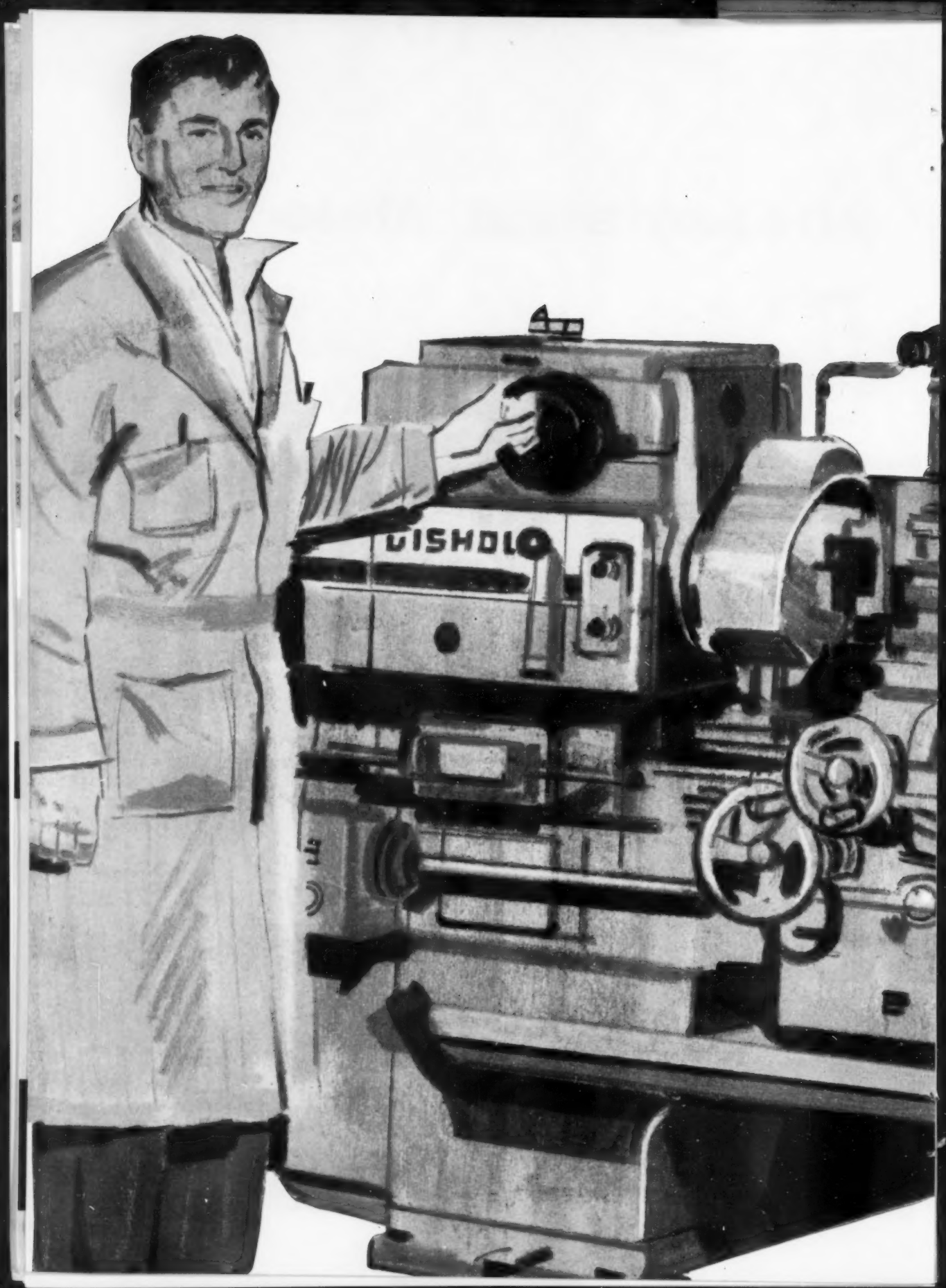
CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

shears steel plate

long



See your Cincinnati Representative for either Heavy or Light Shearing Applications.

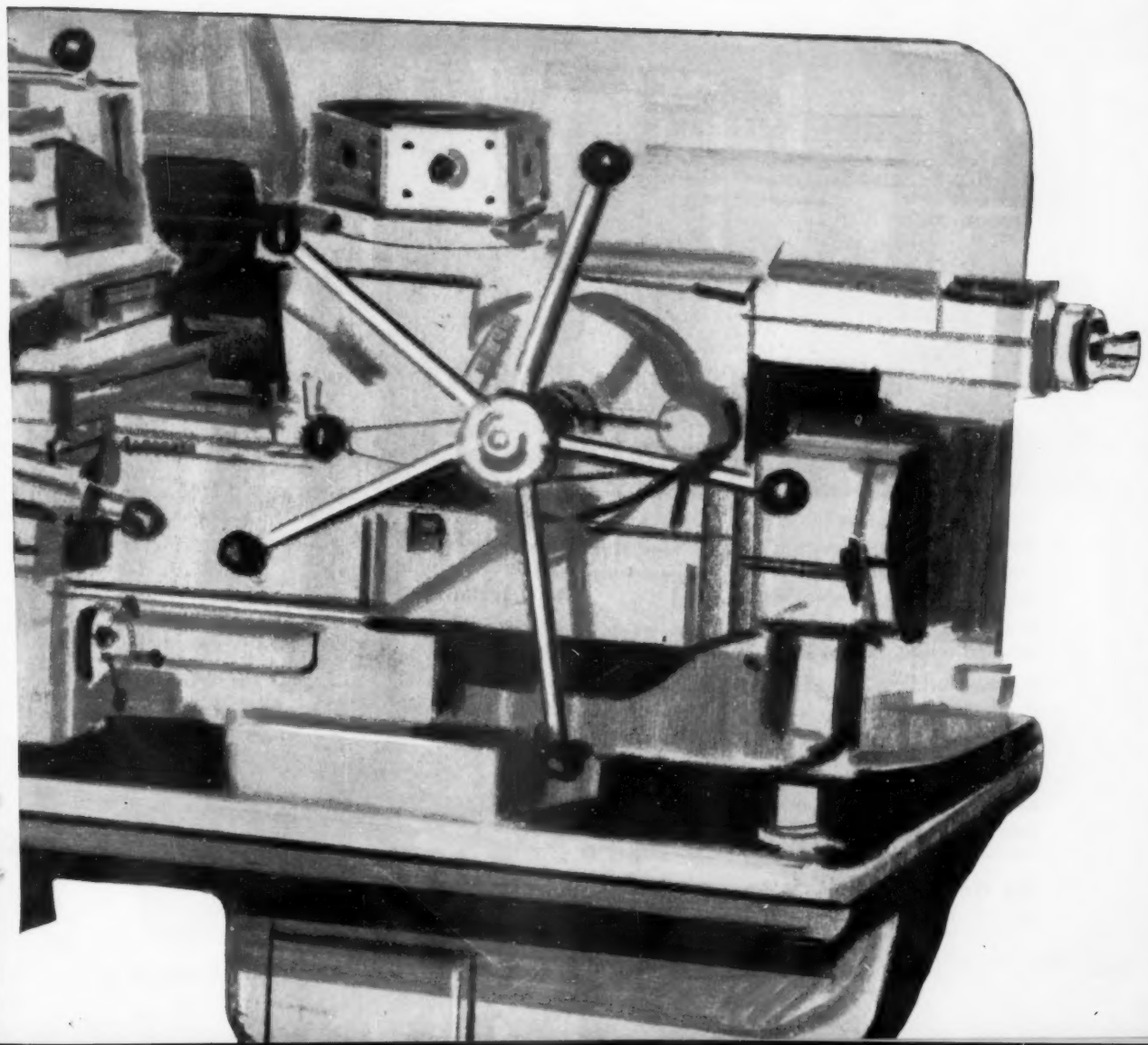

DISHDLO

GISHOLT MASTERLINE
RAM TYPE TURRET LATHE

Here is the latest Gisholt MASTERLINE Ram Type Turret Lathe, with many improvements and outstanding features to provide faster, easier operation, higher quality, quicker setup and lower maintenance. In short, it is designed to do your work faster, cheaper and better—and with a new minimum requirement for operator skill, attention and effort. Let us tell you more about these new machines, and discuss the possibilities of their profitable application to your particular manufacturing processes.

Gisholt Machine Company, Madison 10, Wisconsin

Look ahead—keep ahead—with Gisholt

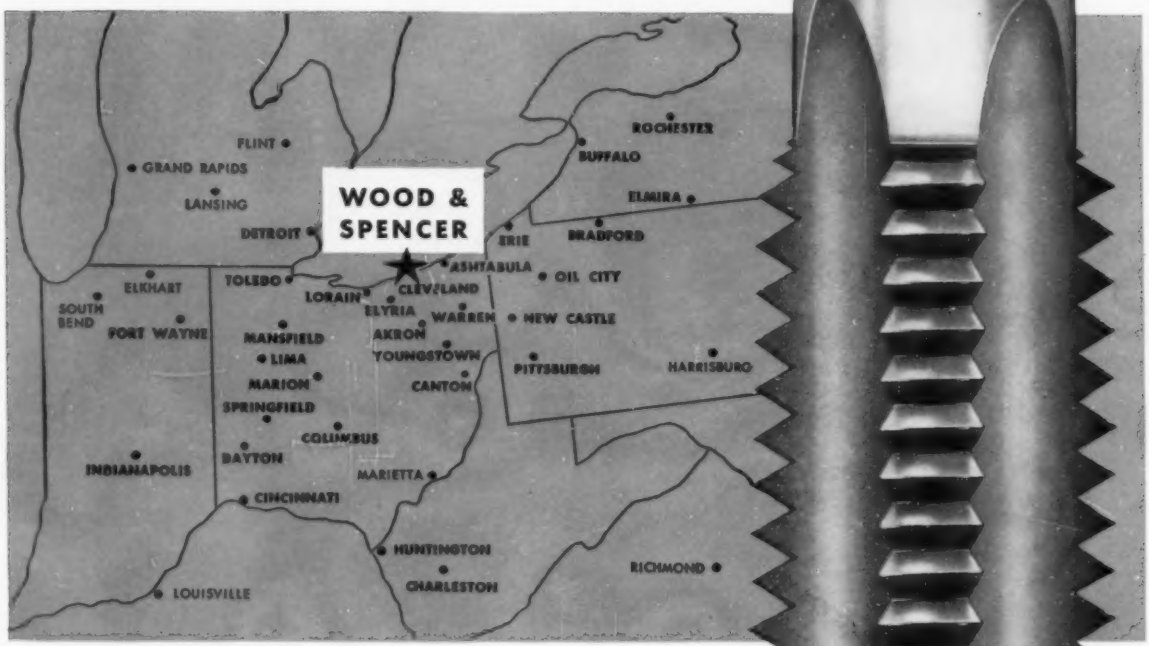


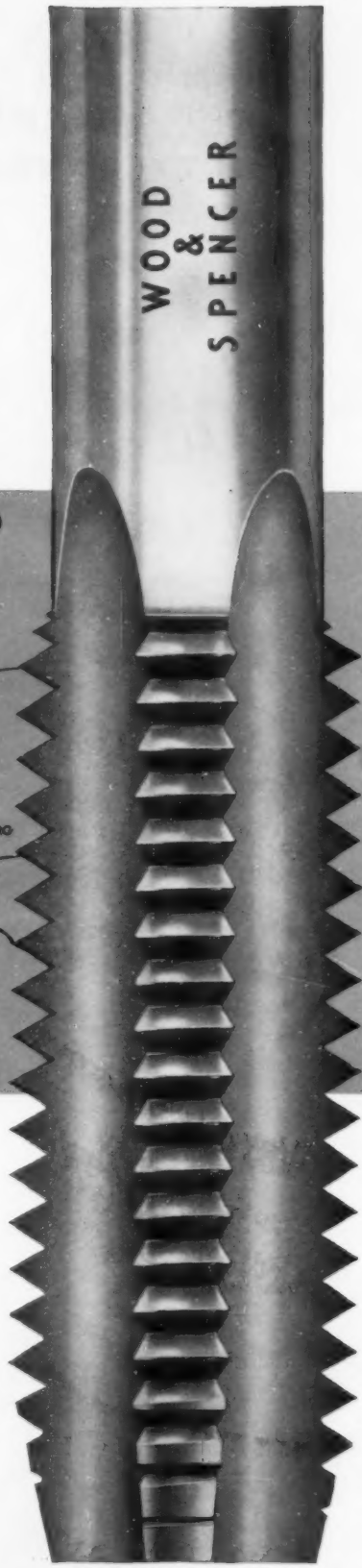
Wood & Spencer

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...in the heart of the metalworking industry





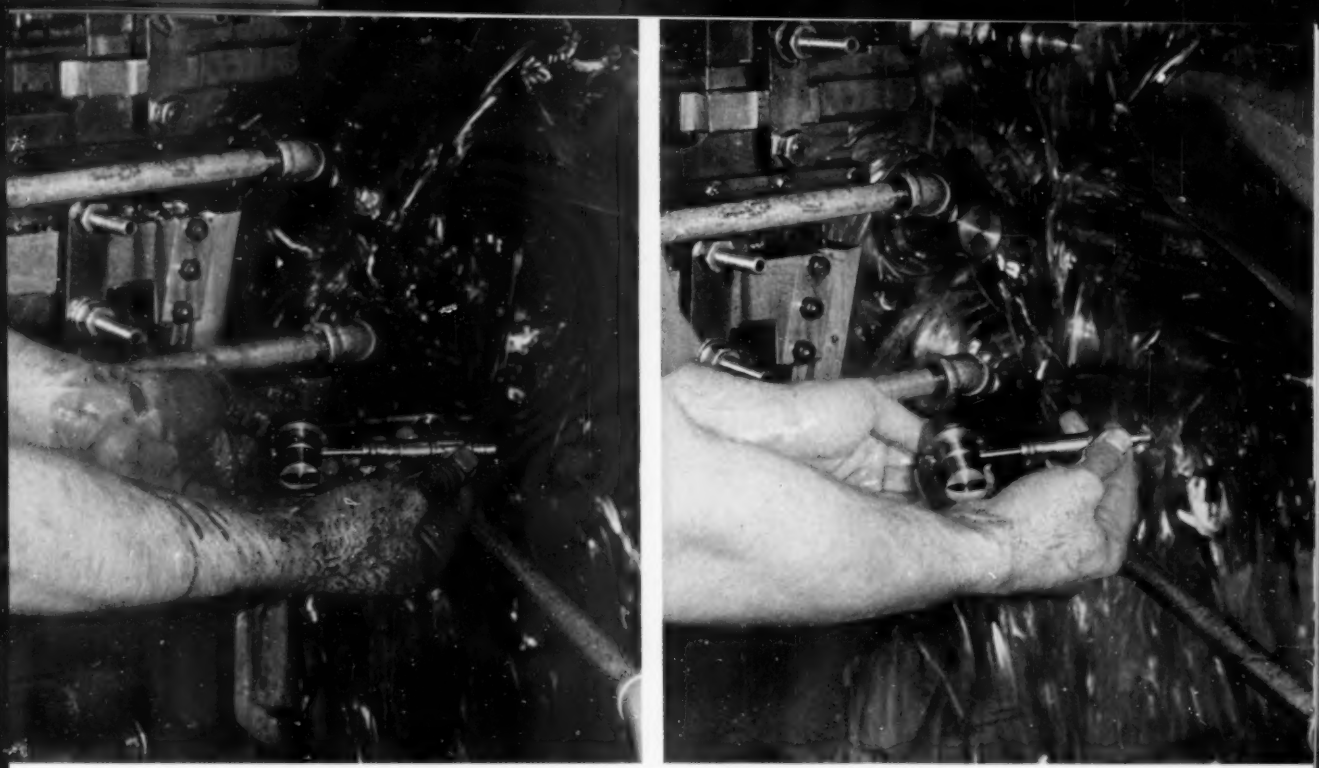
We have gained an outstanding reputation for fast delivery on "specials". And we make immediate shipment from our complete stocks of standard taps.

In addition to *speed* in handling tap orders, we also offer technical assistance when you need it.

Try this service. We think you'll find it a great help when it comes to buying taps or overcoming tapping problems. Remember, telephone orders get immediate attention.

Want a free tap guide! Everyone who has one finds this handy wall chart an excellent ready-reference. It tells all standard gage tolerances, class fits and tap tolerances. Write us for one on your business letterhead.

The Wood & Spencer Company • Cleveland 3, Ohio



Black cutting oil (left) makes close control difficult. Operators dislike dirty operating conditions it creates. Close control is easier and workers are happier with transparent Sunicut cutting oil (right).

WHY USE A BLACK CUTTING OIL WHEN YOU DON'T NEED IT?

Sunicut oils give you better visibility without sacrificing machining efficiency.

When trying to maintain close control over machines producing precision parts, operators can be handicapped by "black-oil blindness". It is hard to see the tools, the workpiece, and the finishes. Checking close tolerances is difficult when the graduations on micrometers and gauges are obscured.

Worse still, as the operator sees it, are the dirty working conditions caused by dark oils. His clothes get saturated with hard-to-remove stains, and his hands are black from one end of the shift to the other.

Transparent Sunicut oils help keep your operators happy and will make close control easier ...and transparent Sunicut oils will do the job with no sacrifice in machining speed or finishes.

To get the full story on Sunicut oils, see your local Sun representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-41.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

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IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL



For any machining or grinding operation...

THERE'S A SUN OIL THAT'LL GIVE YOU HIGH EFFICIENCY AND LOW OVER-ALL COST

No two machine shops have exactly the same problems when it comes to selecting cutting oils...even when they're running the same job. And, until somebody comes up with the truly universal cutting oil, you can't afford to disregard the importance of oil selection. Here's how Sun can help you.

First, Sun makes a complete line of emulsifying and straight cutting and grinding oils. Second, your Sun representative, backed up by field engineers, has the necessary practical experience to recommend the oil that will give you both high machining efficiency and low over-all costs.

For the full story about Sun's cutting oils, see your Sun representative...or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-42.

SUNOCO®

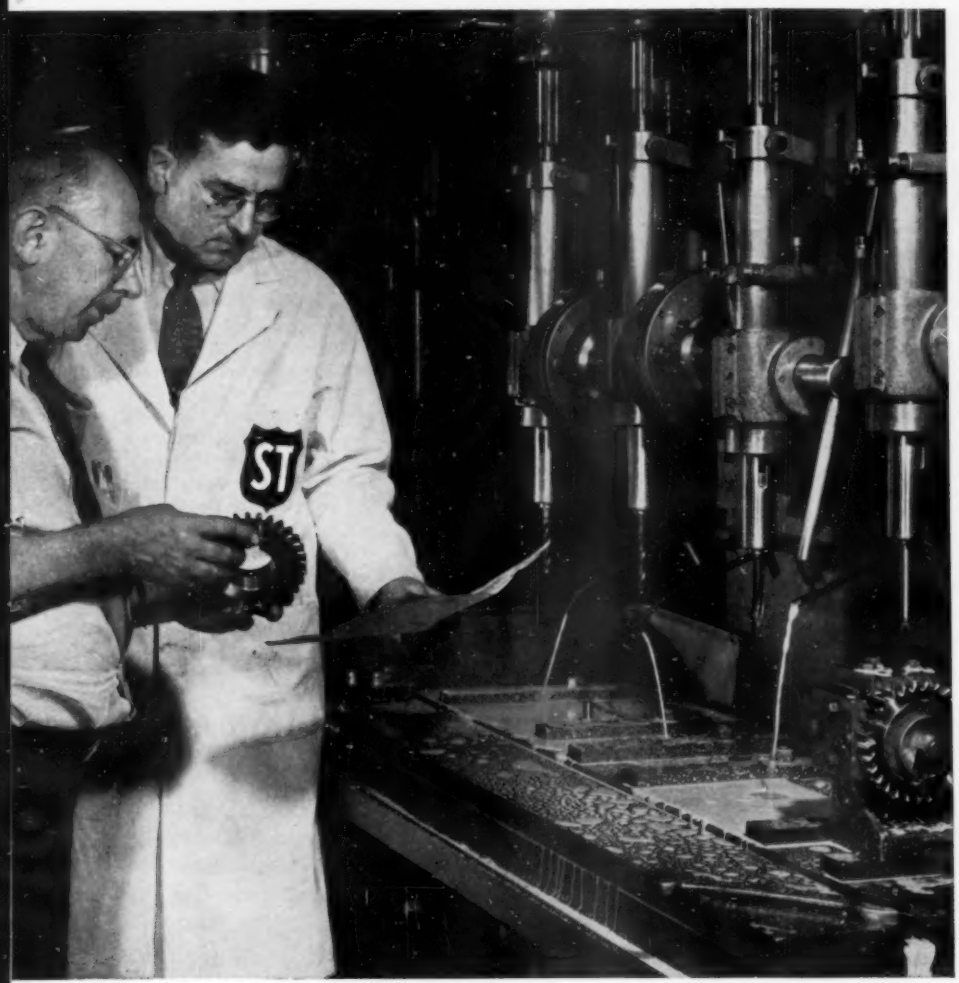
INDUSTRIAL PRODUCTS DEPARTMENT

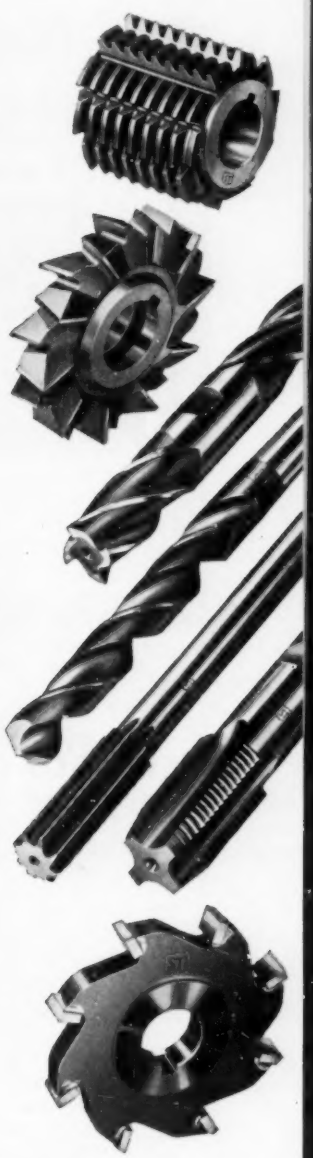
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YOUR STANDARD TOOL DISTRIBUTOR STOCKS THE COMPLETE LINE

● Helping you solve tough metal-cutting problems, speed up production, cut tool costs…these are the STANDARD TOOL MAN'S services to you.

His recommendations have 75 years of industrial experience behind them and are yours without obligation.

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the finest high production lathes

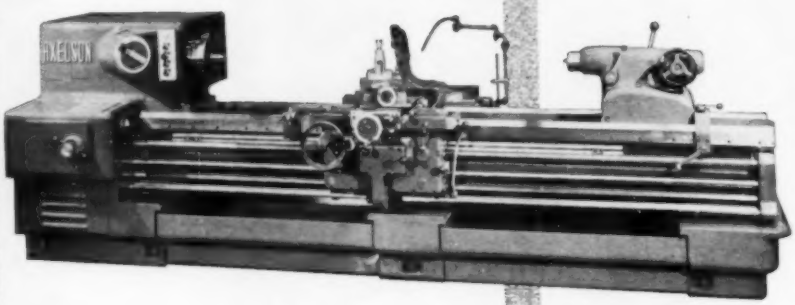
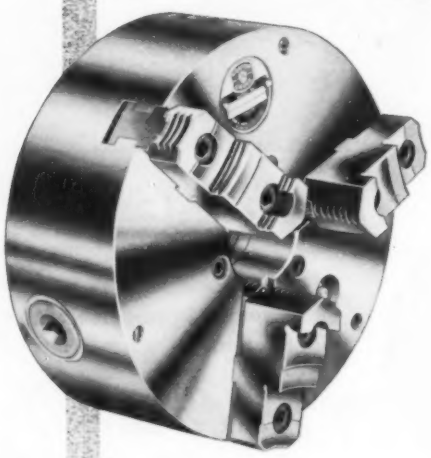


Photo courtesy
Axelson
Manufacturing Co.

Axelson's new 25/16 heavy-duty engine lathe is designed to increase production, reduce turning time and simplify operator control. It features 40 h.p. over 32 spindle speeds, a single lever hydraulic speed selector; 66 feed combinations, exclusive 5-position diameter cross-feed disconnect stop and 7-position longitudinal power-feed disconnect stop. For more information, write Axelson Manufacturing Co., 6160 South Boyle Ave., Los Angeles 58, California.

deserve the finest high production chucks

This is Horton's standard 3-Jaw Scroll Universal Chuck which has contributed to Horton's reputation for chuck leadership for over 100 years. Its precision and lasting accuracy make it a must in any production picture. For the complete story on the complete line of Horton Chucks, see the Horton people in your area now.



HORTON
Since 1851
CHUCK

WINDSOR LOCKS, CONN.



"our twin-head
AXELSON
doubles production of a job we handle with kid gloves"

Mr. S. J. Williams operates S. J. Williams, Inc. in Schiller Park, Illinois.

"When we get a real ticklish job, we handle it with care. These precision radar equipment housings, for example. We built special cabinets to stack them separately while they're in process.

"The Axelson makes it possible to produce two housings in the same setup, because with our Axelsons we can use two identical milling heads on the same machine. No problem of holding tolerance even at the exceptionally high speeds we use. Surface finish is excellent. Spindles can be adjusted in exact relationship to each other. For duplicate milling, you can't find a better setup.

"I know there are all kinds of fine milling machines on the market and all kinds of prices too. But our Axelsons do the job for us. That's why we have two of them."



One of two 10 RH Axelson Milling Machines at S. J. Williams, Inc. Each machine has twin All-Angle milling heads.



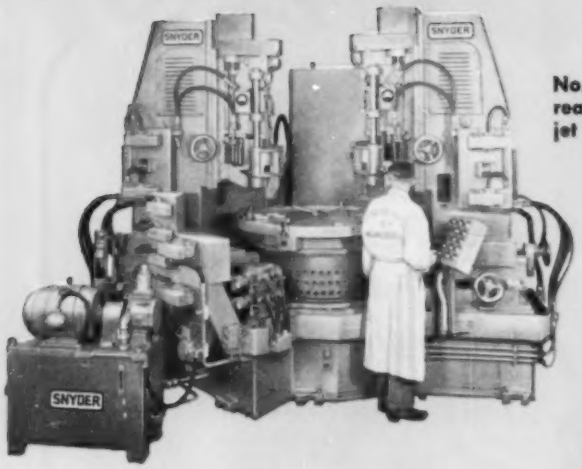
Write for free catalogs on Axelson Milling Machines.

AXELSON
MILLING MACHINES
make man hours mean more

Producers of the World famous Axelson Lathe

AXELSON

AXELSON MANUFACTURING COMPANY
DIVISION OF U. S. INDUSTRIES, INC.
6160 S. BOYLE AVENUE, LOS ANGELES 58, CALIFORNIA • Dealers in Principal Tool Centers of the U. S.



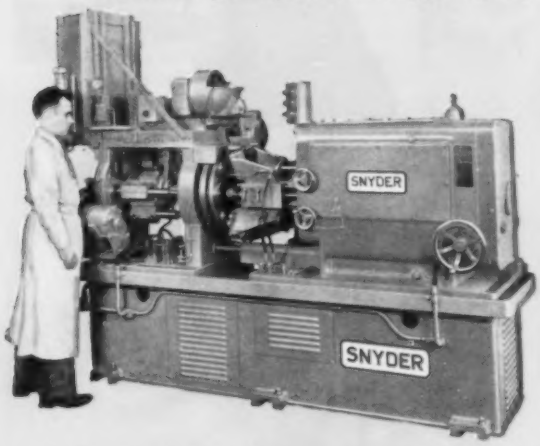
No. 70165—Special index machine to drill and ream holes in rims of outer shroud spacers for jet engines. Production 2 parts per hour.



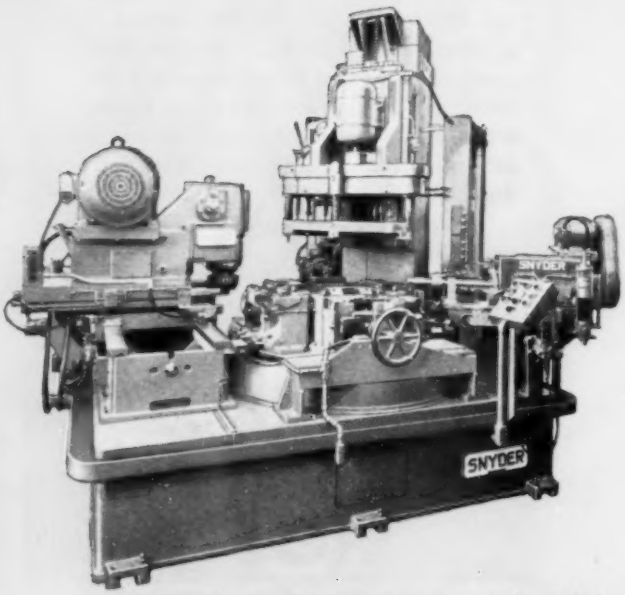
No. 65412—Special automatic machine, for weighing and precision balancing a variety of heavy-duty and diesel engine connecting rods from 7⅜″ to 12″ center distance. Weighs rods and automatically balance mills to plus or minus 2 grams.



No. 207390—Special, double-end precision boring machine for finish boring, counterboring and chamfering counter shaft, intermediate and shifter shaft holes on power take-off cases. Production 82 pieces per hour at 80% efficiency.



No. 68526—Special double end trunnion machine, fully automatic, for machining special aircraft rivets. Machine is automatically loaded and unloaded. Production rate varies with size of rivet.



No. 73902—Special 4-station automatic index machine for milling joint face, drilling and reaming vertical and horizontal holes in exhaust manifolds. Production 80 pieces per hour at 80% efficiency.

SNYDER VERSATILITY

In engineering and building metal-cutting machines includes not only the great Snyder line transfer machines with automation, but also many smaller and diversified machines in which the standards of performance and economy are no less exacting. A few representative examples are shown.

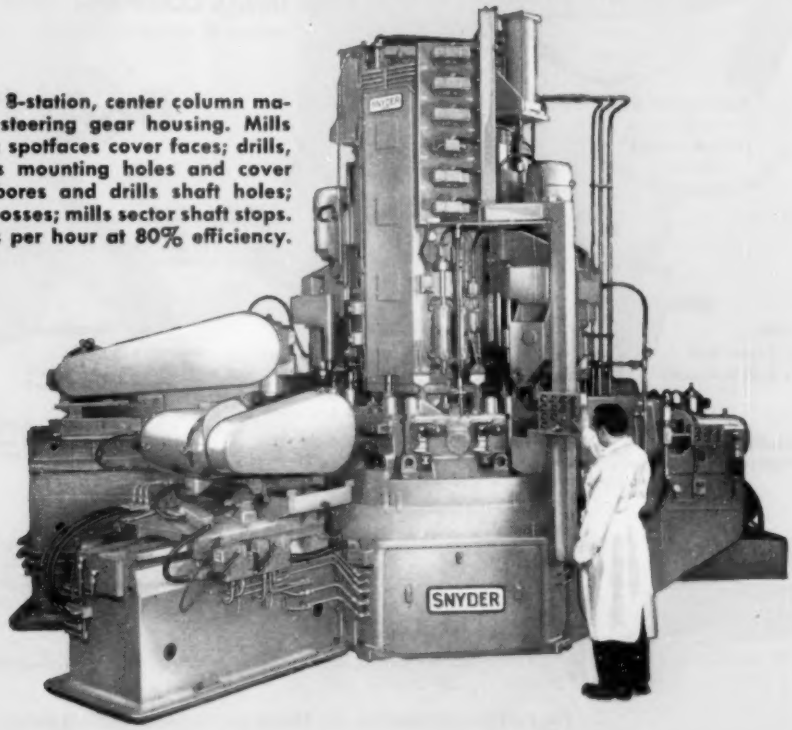
SNYDER

TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

31 Years of Special Machine Tools with Automation

No. 72976½—Special 8-station, center column machine for processing steering gear housing. Mills pads and cover faces; spotfaces cover faces; drills, countersinks and taps mounting holes and cover holes; rough counterbores and drills shaft holes; mills two Welch plug bosses; mills sector shaft stops. Production 260 pieces per hour at 80% efficiency.





High-Speed Steel Saw Bands Bring Big Profits to Cut-Off Operations!

The figures at the left cover just one typical example of the greatly increased cut-off efficiencies made possible by DoALL's new Demon *high-speed steel* saw band on DoALL's new Power Saw.

Performance records from industry prove that plants large and small make big profits on their cut-off work with this new blade and machine combination. They do more accurate work, faster and with less waste of material. They have no trouble meeting production schedules and they often can replace two or three machines with one new DoALL unit.

See the new Demon saw band in operation at your plant — demonstration is free. Just call your local DoALL Store or write:

THE DoALL COMPANY, Des Plaines, Illinois

Makers of Machines and Blades—they go together!

DoALL

Get your copy
"SAWING SAVINGS PROGRAM"
See how DoALL's personalized service is designed to save you money in all your sawing operations.



Free Handbooks

"POWER SAWING"
Cut-off sawing operations—108 pages of "how to do it" at lower costs.

"BAND TOOL MANUAL"
160 pages of saw selection—cutting rates for materials.

Friendly DoALL Stores (in 38 cities)
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SB-40R

Why "foul up" your production with inferior gage inspection when you can get "Major League" performance for "extra innings" with Bath Reversible Plug Thread Gages.



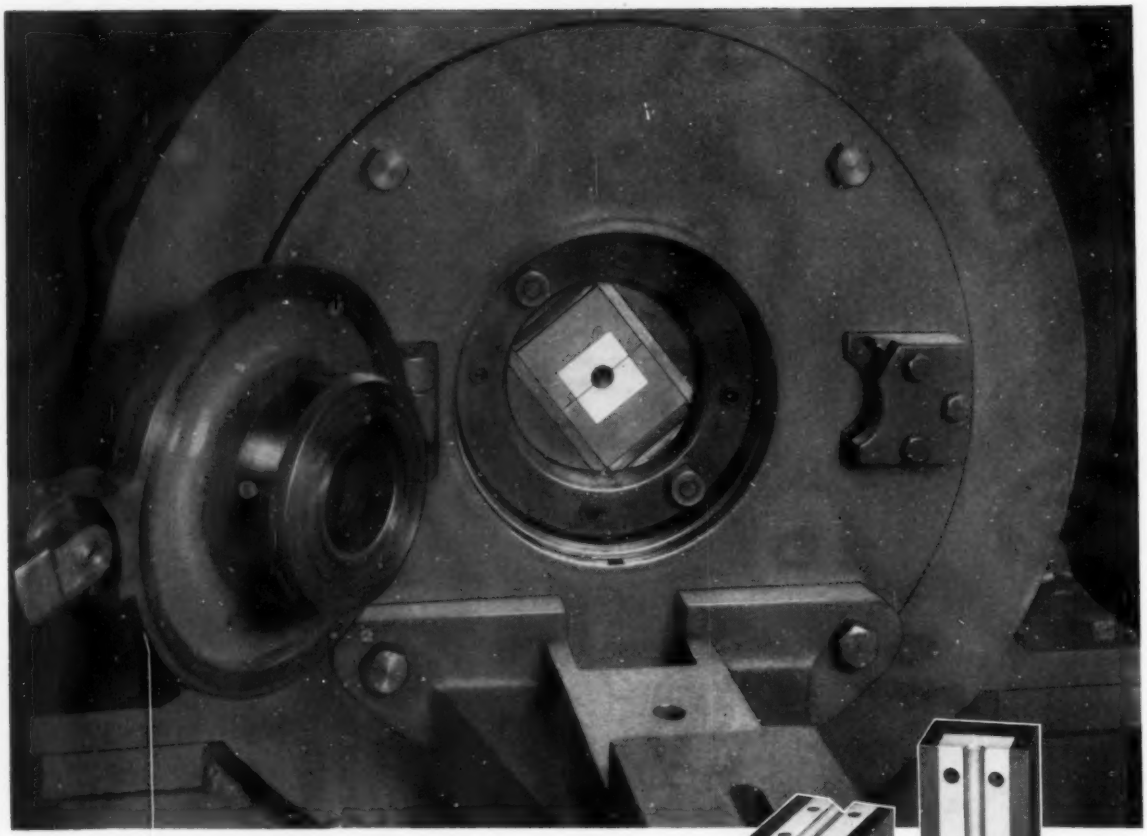
If you're interested in a "no error game" — write for circular today.

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You get best results with KENNAMETAL* Die Grades

Kennametal's "90 Series" with six grades and the exclusive non-galling "80 Series" with three grades provide a range to meet the specific requirements of any die application. Hence, die parts of Kennametal sustain high production rates, maintain accuracy over extremely long production runs with a minimum of maintenance, and decrease operating costs.

Choose Kennametal for your next die parts . . . for blanking, stamping, compacting, perforating, slitting, piercing, cold heading, swaging, forming, cupping, drawing. Kennametal die engineers will gladly work with you in applying the right grade. Call your nearest Kennametal office or write to KENNAMETAL INC., Latrobe, Pennsylvania. Ask for Booklet B-100.

*Registered Trademark

9416

Grade K90 saves $1,575.00 in die costs in 18 months Because of its high resistance to deformation, crushing and edge wear, Kennametal Grade K90, used in the dies shown above for copper tube sizing and straightening, has reduced monthly die cost to only $35.00, as against $122.50 for previous hardened tool steel dies. In 18 months of operation, the saving totals over $1,575.00; and the Kennametal dies are still in operation.

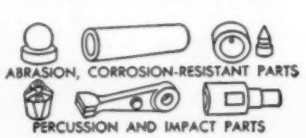
Grade K84 sizes 142,200 tubes against 60,000 . . . with less wear



The effectiveness of the tungsten-titanium K80 Series is demonstrated by a set of eight Kennametal Grade K84 tube sizing rings used to size the I. D. of 5" rocket tubes. With only .010" reduction in ring diameter, non-galling Grade K84 has sized 142,200 tubes, while in comparison another carbide showed .013" wear after sizing only 60,000.



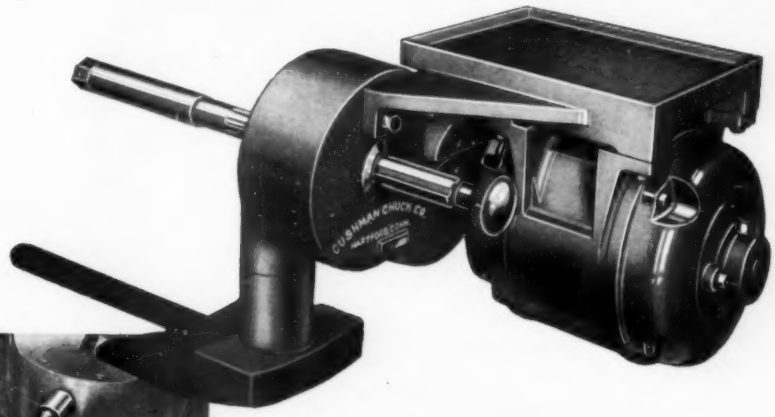
INDUSTRY AND KENNAMETAL ...Partners in Progress



CUSHMAN chucks give Chuck-ability

CHUCK-ABILITY — The ability to SPEED your work . . . ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . . through design and selection of the right work-holding devices.

the key to machining efficiency





The Cushman Power Wrench, push-button controlled, eliminates time-consuming, fatiguing, hand wrenching of chucks on single and multi-spindle machines, especially where repetitive machining operations are being performed.

Cushman Power Wrenches are available with either an 8 or 24 ft. lb. motor, delivering a maximum of 180 or 600 ft. lbs. torque respectively. With the addition of the Cushman Variable Torque Control, developed especially for use with the Power Wrench, the operator may, by setting the selector switch, choose any one of 9 approximately equal stages of torque and inertia. Wrenches equipped with 8 ft. lb. or 24 ft. lb. stall-type motors will deliver from 45 to 180 ft. lbs. or 150 to 600 ft. lbs. respectively.

If greater or less driving force is required, the Cushman Engineering Department can design wrenches to suit your needs. Write Cushman for Bulletin No. 211D fully describing and illustrating the Cushman Power Wrench — or, should you have a special work-holding problem, consult Cushman.

THE CUSHMAN CHUCK COMPANY
Hartford 2, Connecticut

a world standard for precision

CUSHMAN the CHUCKMAN CHUCKS AND ACCESSORIES Exclusively SINCE 1867

CUSHMAN CHUCKS . . .
A Product of American Quality, Labor and Materials

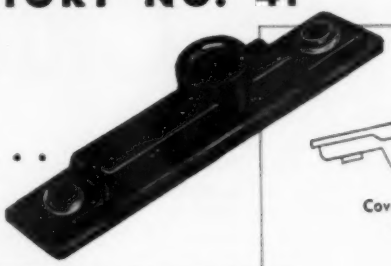
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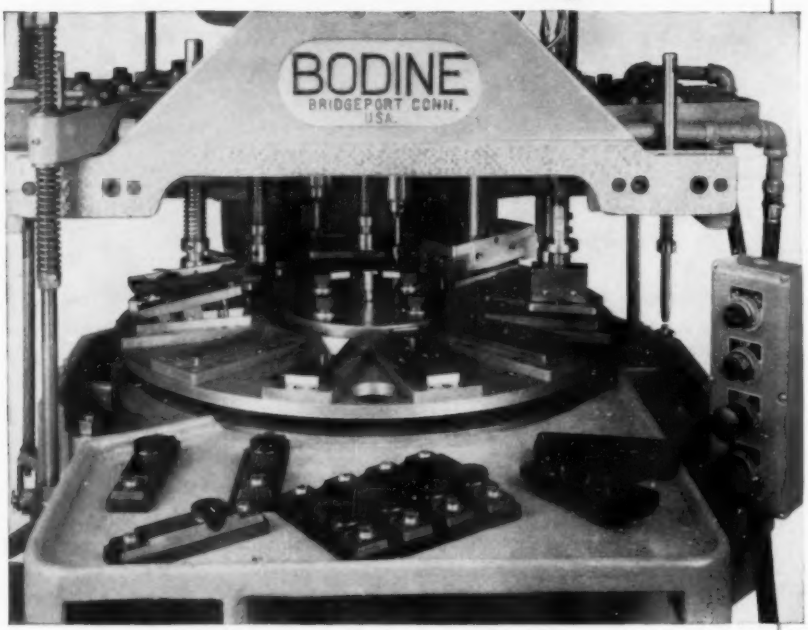
manufacturers of:

Air Operated Chucks, Cylinders, and Accessory Equipment . . . The Cushman Power Wrench . . . Cushman Manually Operated Chucks and Face Plate Jaws.

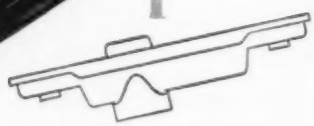
Bodine CASE HISTORY NO. 41

MULTIPLE OPERATIONS . . .
MULTIPLE TOOLING . . .
METAL AND PLASTIC . . .
ON ONE VERSATILE MACHINE



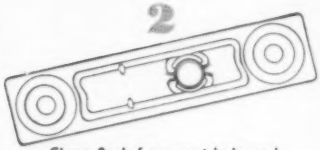


1



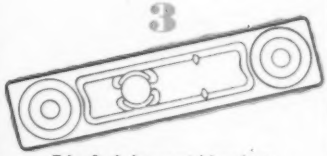
Covers hand-loaded, one piece per stroke.

2



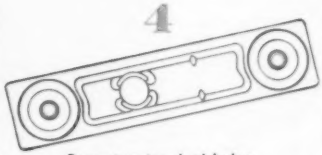
Clean flash from vent hole and slots. Carbide tools.

3



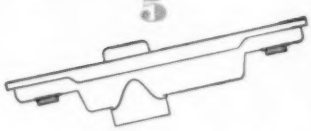
Trim flash from outside edges of cover. Carbide tools.

4



Ream two terminal holes in lead inserts.

5



Hollow-mill two terminals in lead inserts . . . using inverted spindles.

6

AUTO EJECT.

The unusual features of this Bodine tooling lie in the many different types of operations performed in one high-speed cycle, and also in the multiple tooling of the machine to handle many different sizes of these auto battery cell covers, both 6-volt and 12-volt.

Major battery producers now use 15 of these production units. Bodine basic design, as will be seen in the photograph, provides ample room for inclusion of the dies required for trimming operations, as well as the rotary spindles.

PRODUCTION: 1,250 covers per 50-minute hour . . . with machine operating at 25 strokes per minute.

If you are looking for increased output at lower cost, without sacrifice of quality . . . on assembly or production operations, or a combination of both . . . talk to Bodine first. Our experience can save you money and costly engineering.

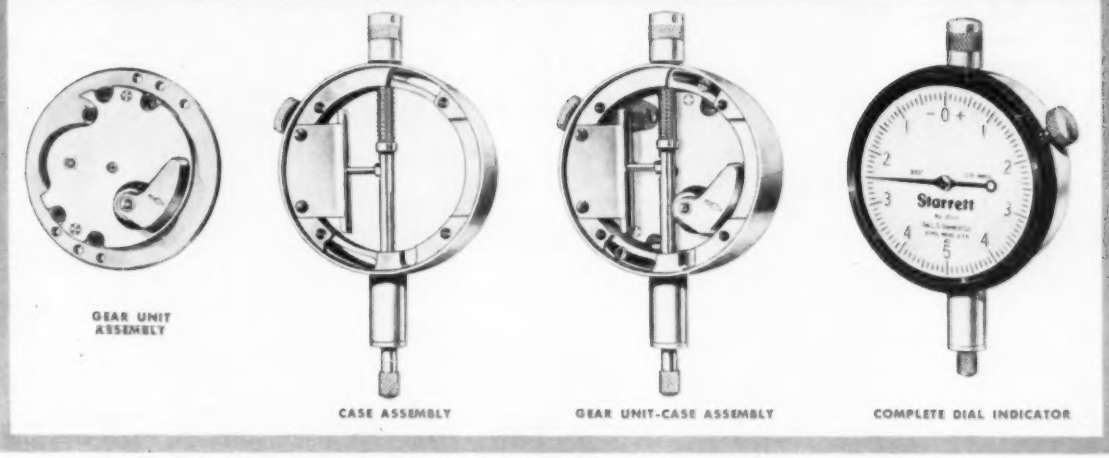
Write Dept. TE-4

THE Bodine CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

78D58

SIMPLE UNIT CONSTRUCTION

for Easier Maintenance, Longer Life, Greater Accuracy



One of the Many Outstanding New Features of

Starrett *HIGH PRECISION LOW FRICTION* Dial Indicators

(Patents Pending)

You can see at a glance how *Simple Unit Construction* makes the new Starrett *High Precision-Low Friction* Dial Indicators so easy to service and maintain. The entire gear mechanism is identical and interchangeable in all No. 25, No. 655 and No. 656 Regular and NON-SHOCK models. Any gear unit and any case assembly can be quickly combined to give you a complete dial indicator. No special techniques are required. Maintenance time and upkeep costs are reduced to the barest minimum.

Simple Unit Construction also means fewer parts for greater efficiency, less friction and wear, longer life. The new super-sensitive, low friction, low inertia movement with high efficiency gear train insures greater accuracy and sensitivity for exact duplication of repetitive readings.

Send for catalog describing the many outstanding features of Starrett *High Precision-Low Friction* Dial Indicators . . . the world's most complete line.

The L. S. STARRETT COMPANY, Dept. E
Athol, Massachusetts

Please send information on Starrett *High Precision-Low Friction* Dial Indicators.

Name.....Title.....

Company.....

Street and Number.....

City.....Zone....State.....

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THE L. S. STARRETT COMPANY, ATHOL, MASSACHUSETTS, U. S. A.

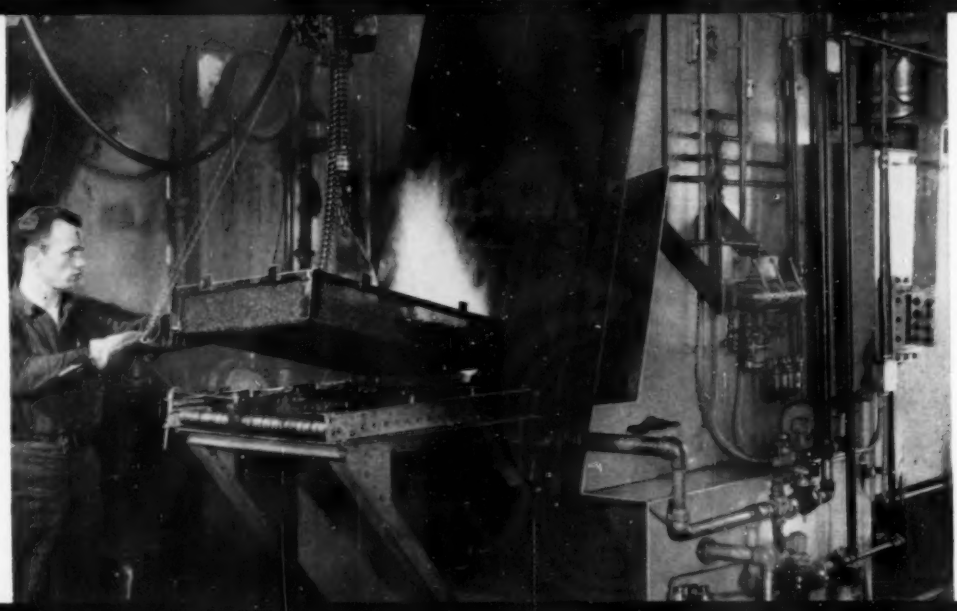
ALLIED

New Lindberg electric furnace with CORRTHERM element at Allied Metal Treating Corporation, Kenosha, Wisconsin. This furnace is used 24 hours a day, 6 days a week, for carbonitriding, clean hardening pinion gears, hardening crank shafts after carburizing and carburizing small gears and shafts.



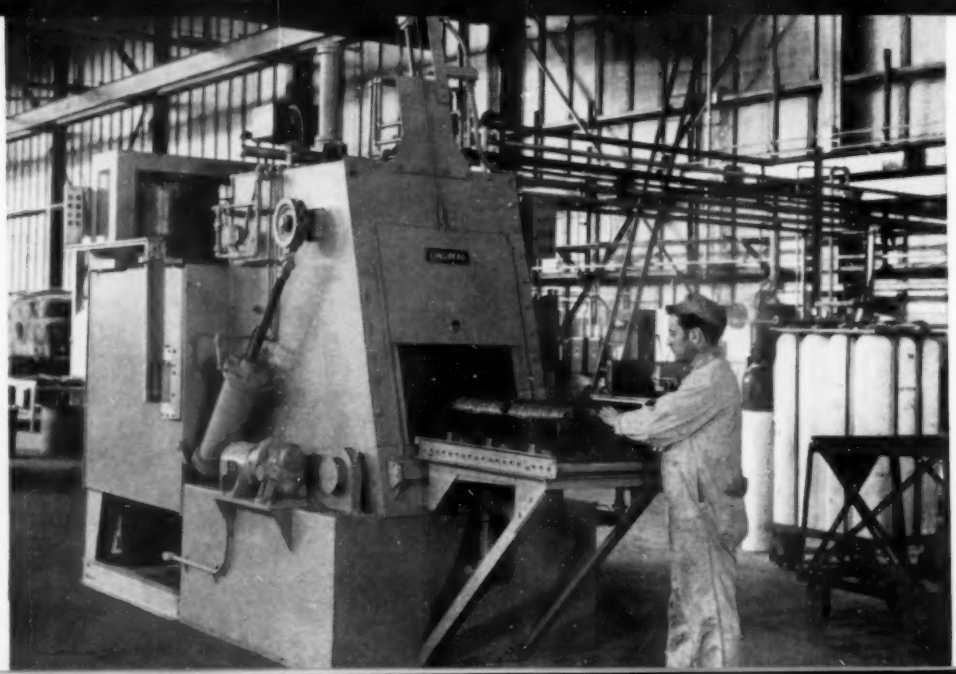
EKLUND

Installation of new Lindberg furnace with CORRTHERM electric element at Eklund Metal Treating, Inc., Rockford, Illinois. Furnace used 24 hours a day, 7 days a week, for carburizing gears and machine tool parts, carbonitriding sheet metal screws and automotive parts, and hardening and tempering bolts.



PERFECTION

Lindberg electric furnace with CORRTHERM element just installed at Perfection Tool & Metal Heat Treating Company's Lombard, Illinois plant. This furnace is being used 24 hours a day, 6 days a week, for carbonitriding and carburizing parts for automotive and farm implement industries.



COMMERCIAL HEAT-TREATERS QUICK TO ADOPT LINDBERG ELECTRIC CARBONITRIDING FURNACES WITH NEW CORRTHERM HEATING ELEMENT

It is significant that commercial heat-treaters, always in the lead in the acceptance and development of better heat-treating methods, have been among the first to appreciate the revolutionary advantages of Lindberg's newly announced CORRTHERM electric heating element.

Recent Lindberg CORRTHERM-equipped furnace installations in plants of three leading midwestern commercial heat-treaters are shown on the opposite page.

Where electricity is the preferred source of heat Lindberg furnaces with CORRTHERM provide to the fullest degree the versatility and dependability required in efficient commercial heat-treating. Ideal for carbonitriding, they are readily applicable to other processes—carburizing, carbon restoration, bright hardening or annealing, and normalizing.

Whether your heat-treating operations are commercial or captive, large or small, the CORRTHERM element in Lindberg electric furnaces offers you these exclusive advantages:

Low voltage—operates at extremely low voltage. No leakage through carbon saturation.

Atmosphere Circulation—elements act as baffle to direct circulation of convection streams.

Safety—extremely low voltage eliminates shock or short hazards.

Durability—watts density at all time low. Element practically indestructible.



This shows how the new Lindberg CORRTHERM electric heating element fills the furnace with walls of glowing heat. Note also that CORRTHERM is conveniently hung from simple brackets requiring no complicated connections or construction.

CORRTHERM is an exclusive Lindberg development created in Lindberg laboratories by Lindberg metallurgists and engineers. To find out how its advantages can be applied to your heat-treating processes consult your nearest Lindberg Field Representative. (Look in classified phone book.)

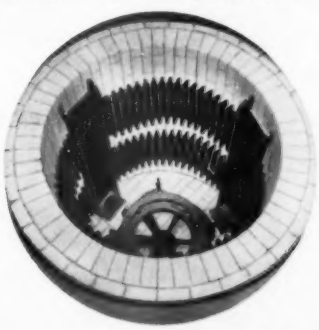
LINDBERG ENGINEERING COMPANY

2447 West Hubbard Street, Chicago 12, Illinois

Los Angeles Plant: 11937 Regentview Ave., at Downey, California



Installation of CORRTHERM elements in one of two large rotary furnaces just erected in the field by Lindberg's associate company, Lindberg Industrial Corporation.

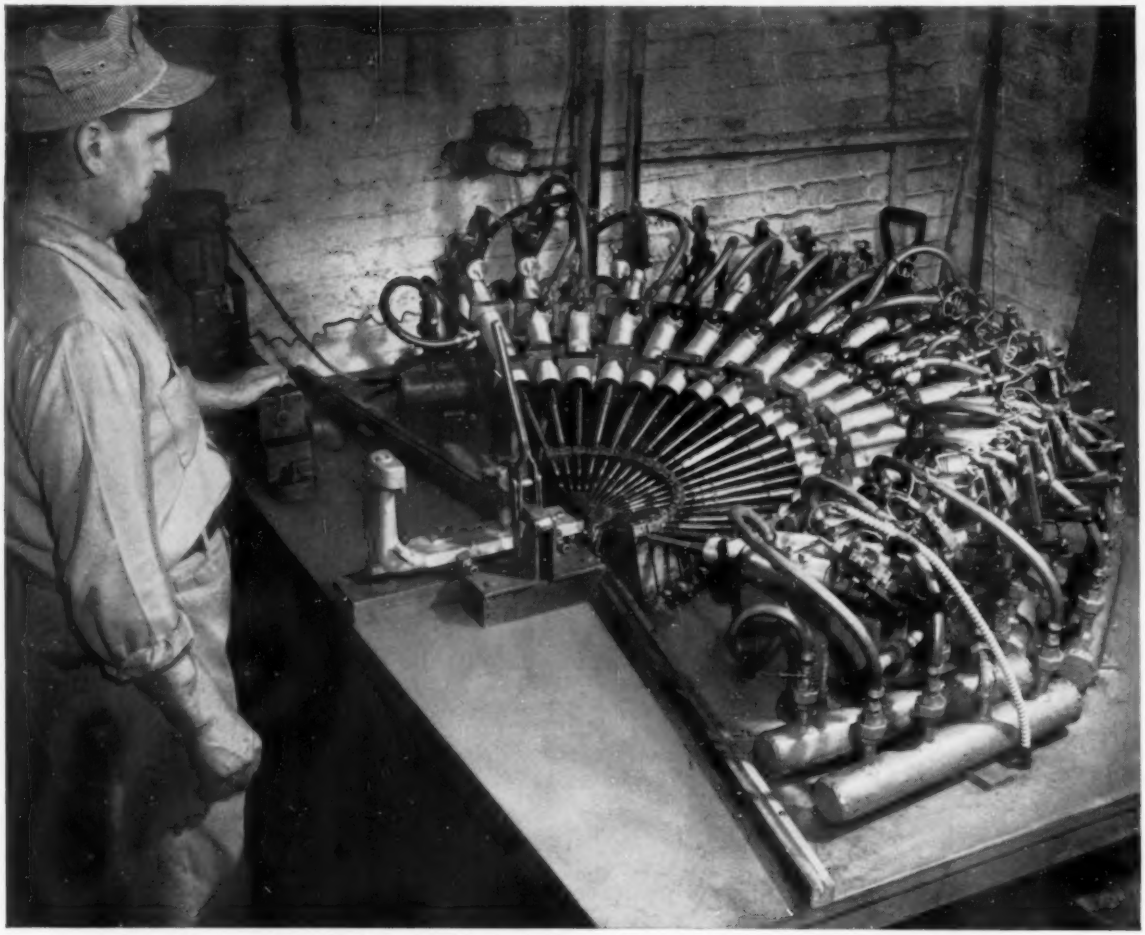


Installation of Lindberg CORRTHERM-equipped carburizing pit-type furnace in plant of Lindberg Steel Treating Co., Melrose Park, Ill.



Safety! Extremely low voltage makes CORRTHERM elements completely safe. Let operator or work load bang it if they will. Neither element nor operator will be hurt.

Gardner Denver . . . Serving the World's Basic Industries



Showing how the Airfeedrills are held in the fixture and how the burner casting is mounted in the jig. Manifolds, which assure proper air volume, are mounted on the bench around outside of tool fixture.

Press a button . . . 20 drilled holes! Use Keller Tool time-saver Airfeedrills

Hole drilling on this gas burner was a time-killer before Keller Tool Airfeedrills® took over. The job was formerly hand-indexed for each of the 20 holes. The drill press spindle was hand-fed for each hole.

Operator now presses the button on a 4-way air valve. Presto, 20 drilled holes in a 40-second cycle—automatically. The drills start simultaneously, advance, drill the holes, retract and shut off—automatically.

Keller engineering ingenuity + Keller air tools = production cost reductions. How about investigating?

GARDNER - DENVER

KELLER TOOL division, Grand Haven, Michigan

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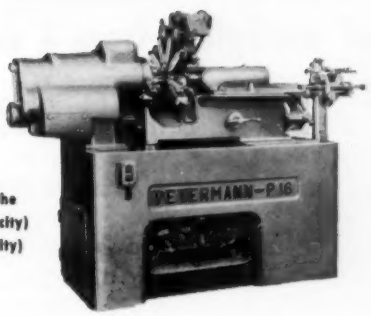
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Absolutely unique in its field!



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2) Can thread right or left hand, internal or external, any number of threads of different diameters, pitches or lengths?
3) Can rearrange these spindles quickly without dismantling the turret?
4) Can supply a variety of speeds, at will, by simple positioning of pins? No special cams or gear changes!
5) Offset the turret drum for recessing, etc., quickly and easily?
6) Provide fast approach and return of any spindle, without special cams, by simple positioning of trip dogs?
7) Index the turret in ⅔ of a second? This is constant, not dependent on the cycle time!



Supplied with the
P-16 (½" Capacity)
P-25 (1" Capacity)

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PHOTO COURTESY OF DANROY BORING CO.

DeVlieg *SPIRAMATIC* JIGMILS® permit accurate machining of workpiece from 4 sides at 1 setting!

The above photograph, taken in a well known Detroit Tool Shop, illustrates a Special Hydraulic Fixture being machined on a DeVlieg Model 3B-48 *SPIRAMATIC* JIGMIL. This job was completely machined on four sides at one setting to precise limits of accuracy and operations included drilling, boring, milling and O.D. turning 22" diameter trunnion.



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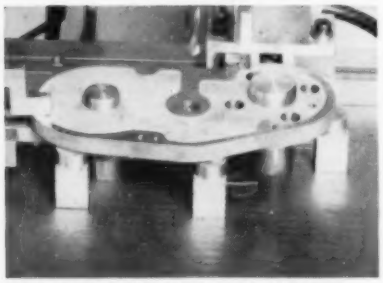
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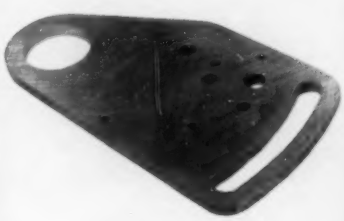
Request your copy of this descriptive new booklet on CLEVELAND Carbide Tools

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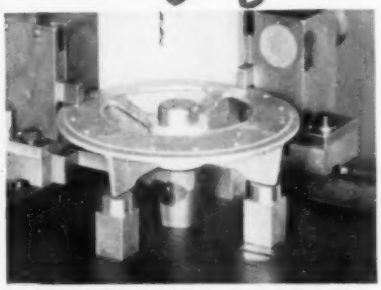
DRILL PARTS LIKE THESE . . . *Without Jigs!*



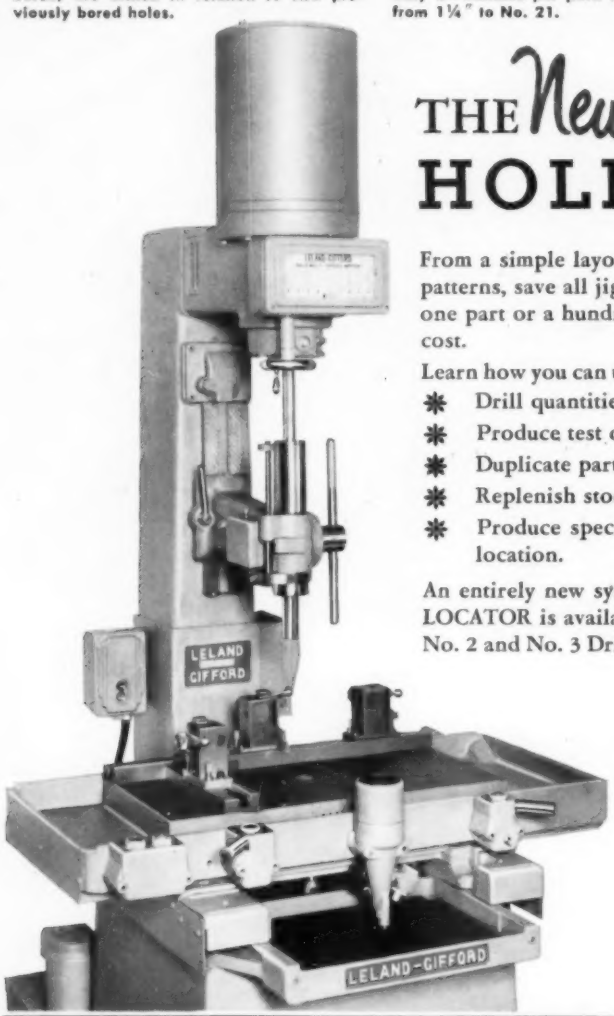
Thirteen holes (4 tapped, 1 reamed, 4 counterbored) are drilled in relation to two previously bored holes.



Nine holes plus five extra operations take only 24 minutes per part. Hole sizes range from 1¼" to No. 21.



Twelve holes are drilled and tapped in this aluminum motor fan in precise relation to the hub and webs.



THE *New* LELAND-GIFFORD HOLE LOCATOR

From a simple layout chart, you can locate and drill complex hole patterns, save all jig costs, eliminate piece by piece layout, produce one part or a hundred in a fraction of the time, at a fraction of the cost.

Learn how you can use the new Leland-Gifford HOLE LOCATOR to:

- Drill quantities of parts not requiring jig borer accuracy.
- Produce test or experimental pieces.
- Duplicate parts for repair or maintenance.
- Replenish stocks of replacement parts.
- Produce special parts requiring modification in hole size or location.

An entirely new system for locating and drilling holes, the HOLE LOCATOR is available in the capacities of standard Leland-Gifford No. 2 and No. 3 Drilling Machines. Write for complete information.

HOW IT WORKS

Hole locations are precisely established from intersecting lines scribed on a metal chart from blueprint dimensions. An optical viewer with double cross hairs and 20X magnification aligns the table with the layout chart which is registered in relation to the machine spindle. Dual locks release to permit lateral, forward and back, or compound motion of the table. The work is held on the table by quick-acting clamps. Duplicate parts can be produced from the same layout or the chart can be filed for future use.

LELAND-GIFFORD
Drilling Machines

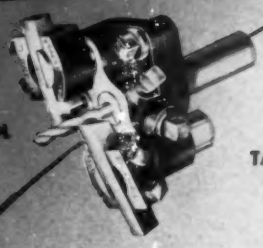
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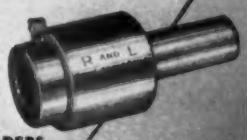
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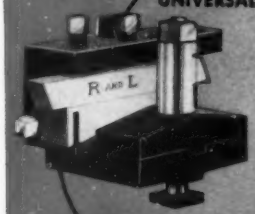
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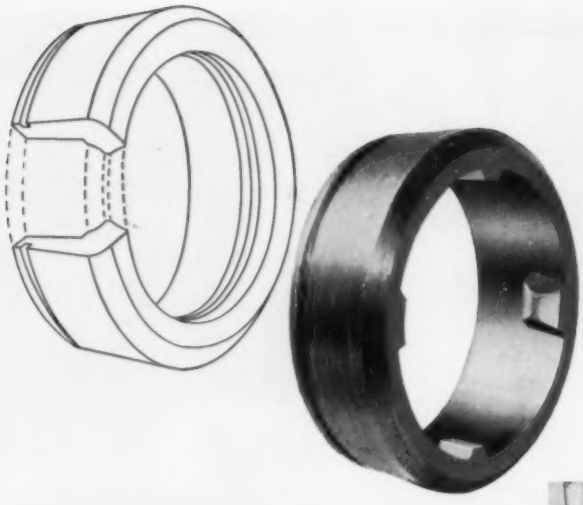
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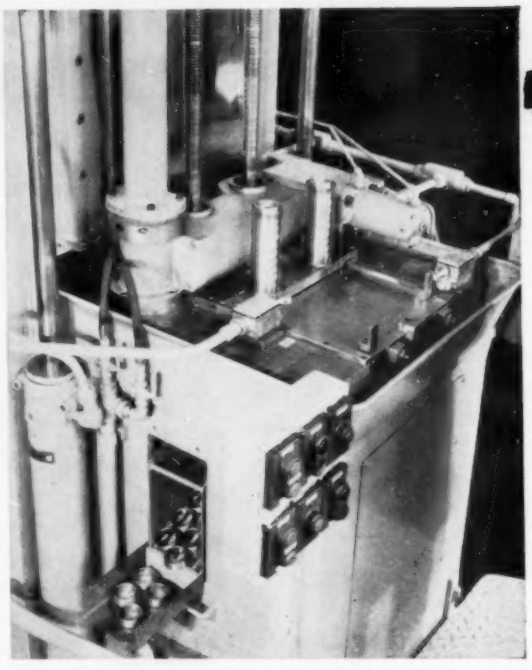
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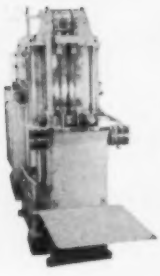
TE-4



I. D. and four inverted helical splines **BROACHED** *the American way*

. . . 300 parts per hour





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FIXTURES
American hydraulic slide unit with feed tubes and automatic clamping and ejection mechanism.

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American combination round-and-spline broaches with helical spline teeth.

American engineering made this broaching operation fast, automatic and economical.

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You may have parts that can be produced at significantly lower cost by broaching them the American way. Send part print or sample . . . American engineers will make a recommendation you'll find valuable.



American Catalog 450 is a complete broaching manual . . . write for it today.

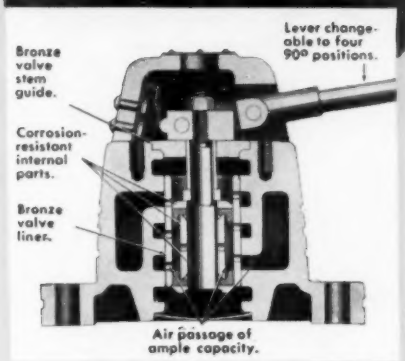
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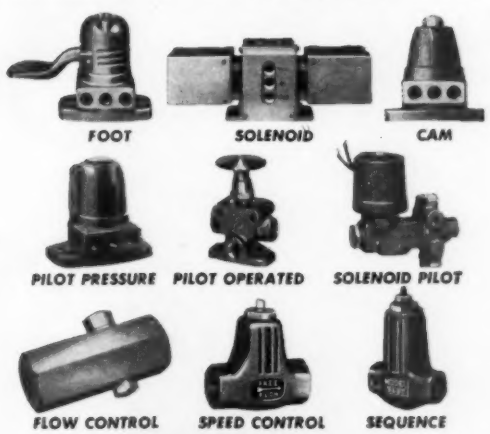
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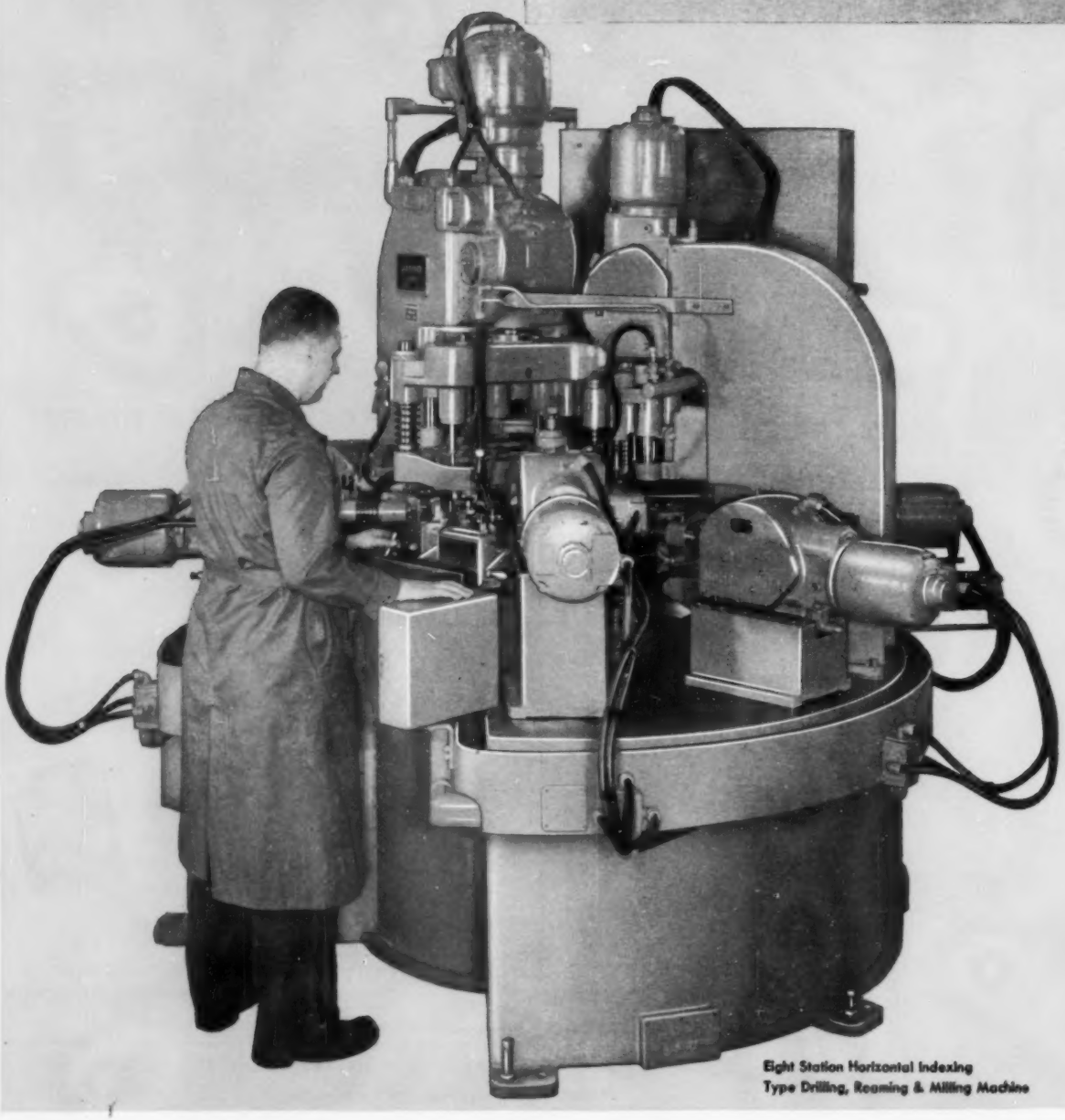
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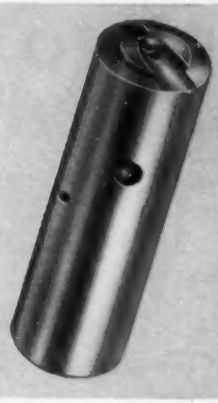
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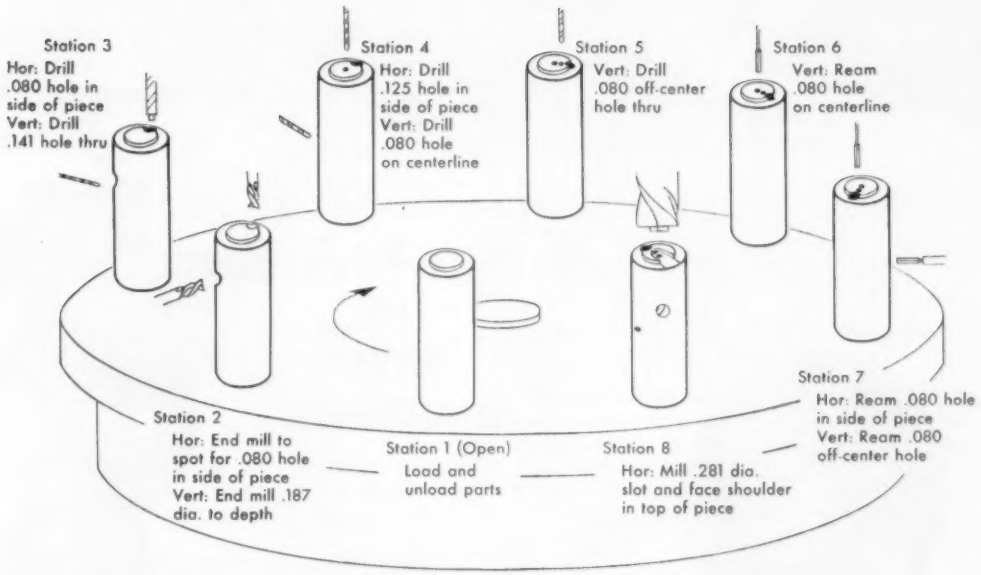


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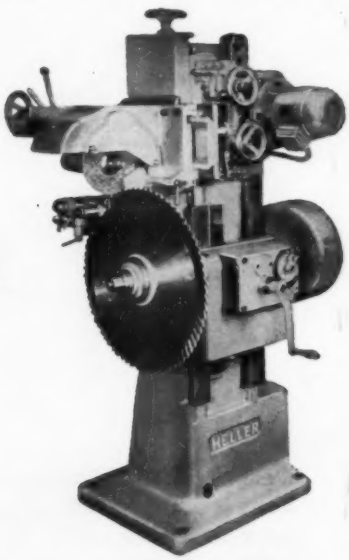
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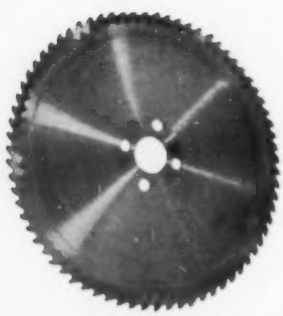
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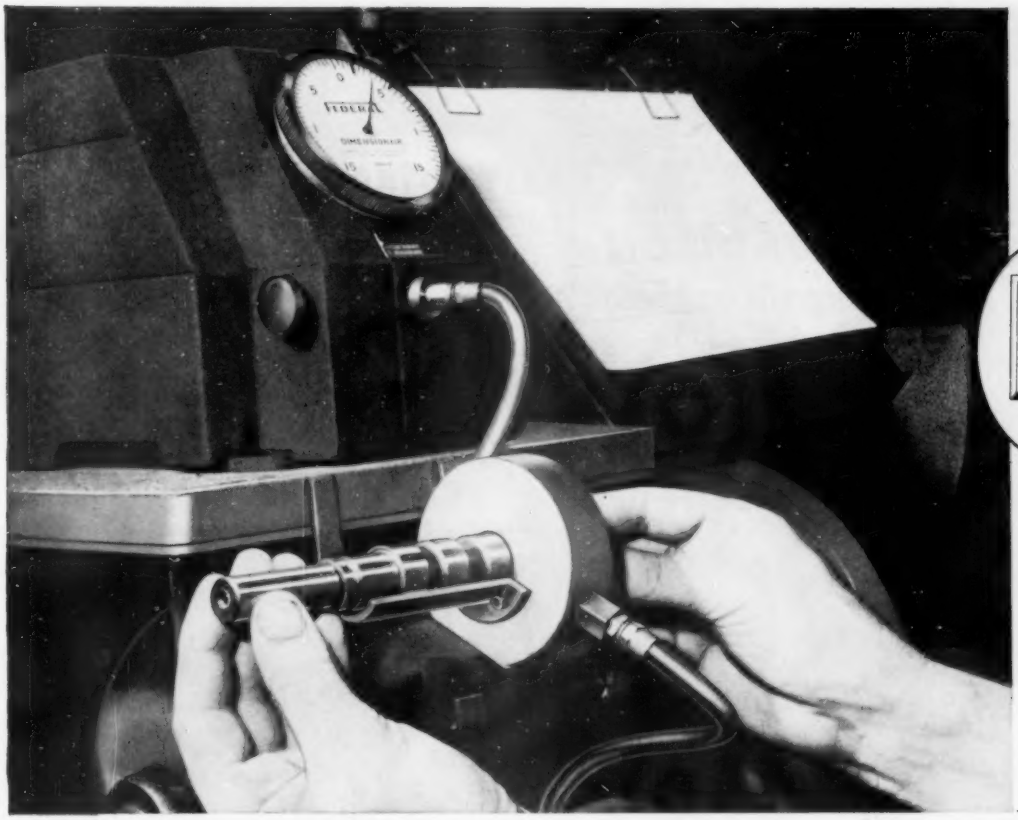


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Diameters 1" up

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For finishing a hole to size with close tolerance and good finish, use the MADISON Reaming Tool. The MADISON feature of Interchangeability and Controlled Float are inherent in every MADISON Tool.

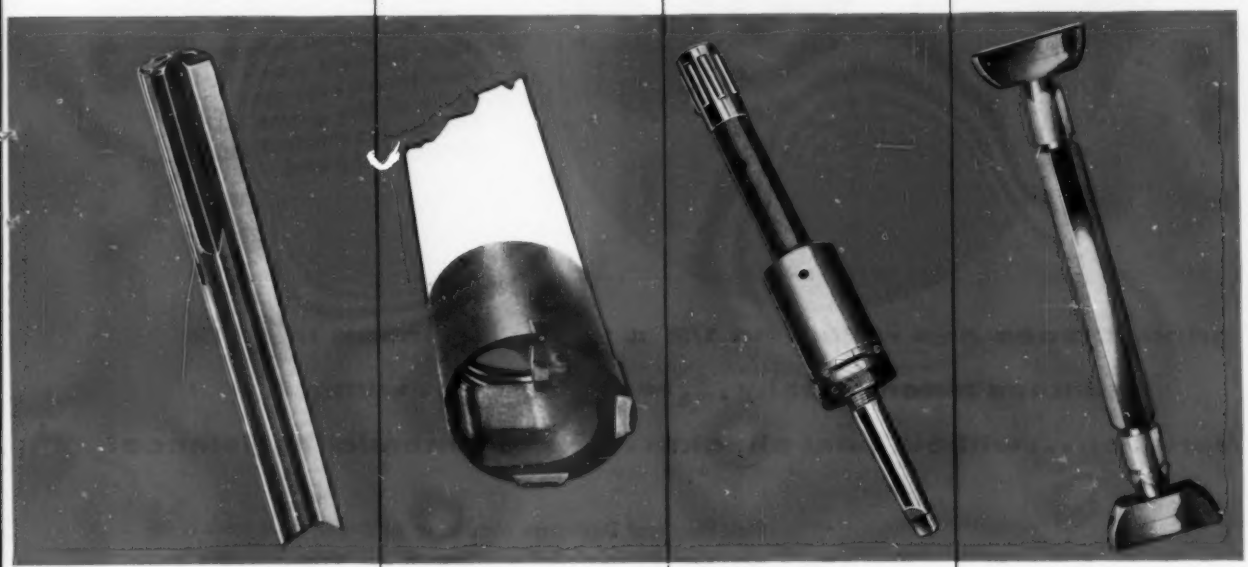


You buy more than just hole-making tools when you buy MADISON Tooling. You get the knowledge and experience of MADISON'S veteran tool engineers. This service is available to you at all times. These experts, whose chief concern is inner diameters, are on the job to lower tool costs and increase production for you. To get their unbiased recommendations, submit a part-print or sketch of hole problems. The men with holes in their heads will then see to it that you get the right MADISON tool for your applications.

phase of **Inner Diameters**



Diameters 5/32" to 2"	Diameters 2" up	Diameters 1/4" to 12"	Diameters 3/4" up



For producing truer, more accurate, finer finished holes, in one operation from the solid through gun-drilling techniques, use MADISON Deep Hole Drilling Tools. Unexcelled for both deep and shallow drilling applications.

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"inner diameters are our business"

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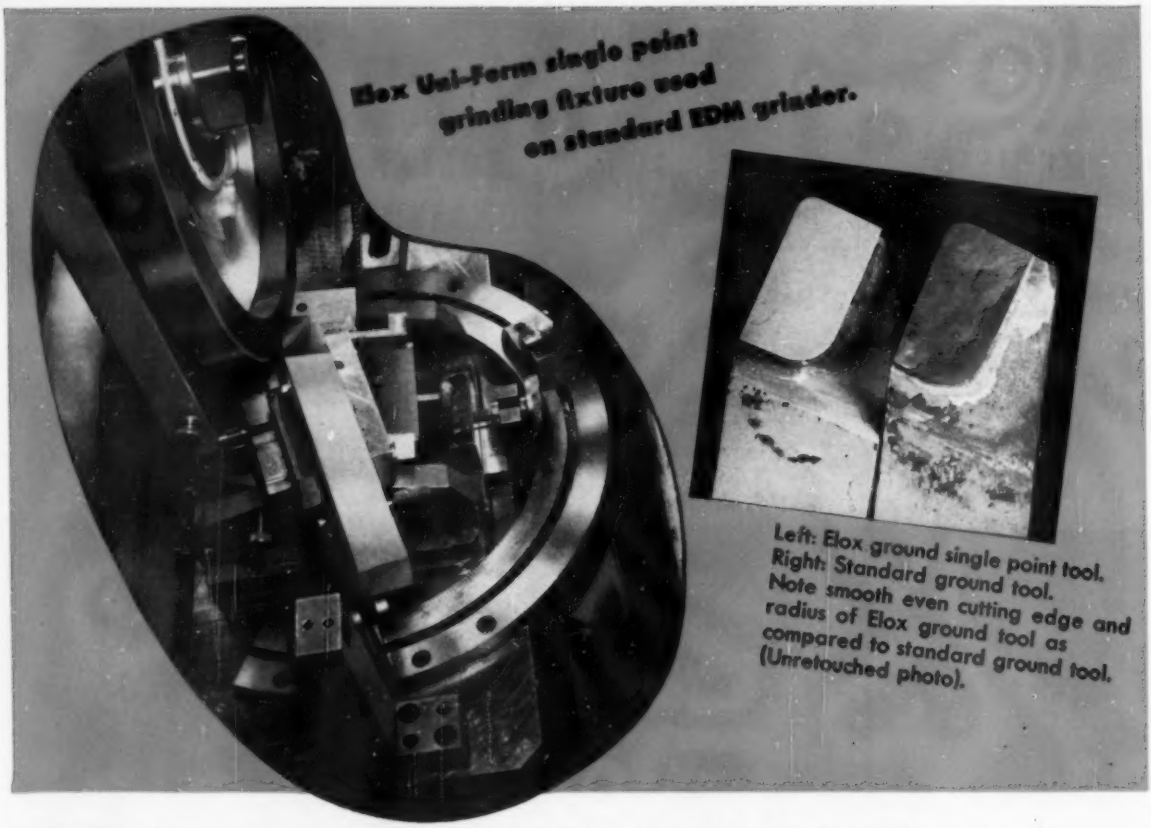
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☐ Adjustable Reaming Tools ☐ Trepanning Tools ☐ Adjustable Boregages

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grind 2 faces and radius on 1/2" x 1" carbide insert in 3-1/2 minutes automatically . . . repetitively . . . without variation . . . without heat checks . . . without manual assistance!

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Elox Electrical Discharge Machining of single point tools is an electronically controlled push button operation. Variable human elements are completely eliminated, guaranteeing every tool sharpened identical as to finish, radius.
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Advantages of Elox Uni-Form Tool Grinding:

- **Permits use of standard blanks**
- **Every tool is identical as to radius, finish**
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- **Eliminates diamond wheels**
- **Carbide and tool shank are ground simultaneously**
- **Averages 40% labor savings**

See Elox Uni-Form Single Point Tool Fixture in operation at Elox Demonstration Centers.

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*T.M. Reg.



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Cuts cast steel, cast iron, chilled iron, carbon steel, high-speed steel, non-ferrous metals

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for example

High-Speed Steel In machining high speed steel (207-B annealed) with hardened high speed steel tools, cutting speed was from 80 to 100 sfpm. Stupalox provided a cutting speed of 505 sfpm with .023″ feed and .125″ depth of cut.

SAE 1035 Steel SAE 1025 steel was cut with tungsten carbide tools at a speed of 250 to 350 sfpm. Stupalox cut the same material on the same machine at 1175 sfpm. Feed was varied from .015 to .005 and the depth of cut from .005 to .250 to demonstrate the tool's versatility.

* * *

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BARBER-COLMAN offers

Special Form Development

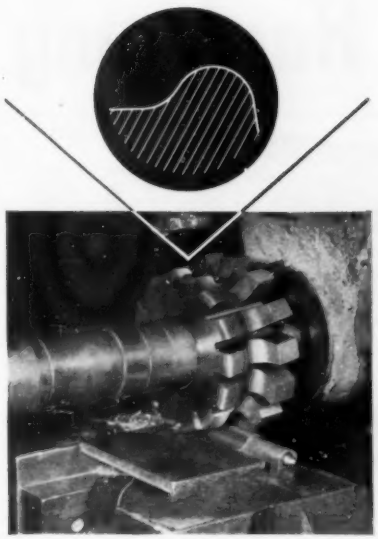
Special form-relieved cutters often allow several operations to be combined into one. Barber-Colman Engineers are experts in designing special tooth forms on form-relieved cutters for solving specific milling problems.

Our cutting tool division has the complete engineering, manufacturing and inspection facilities for making specially-designed form-relieved cutting tools of the finest quality. In addition to designing special forms, our engineers will design into the cutter such special features as axial side clearance, rake angles and helical flutes in any combination to produce maximum cutting efficiency. The best high-speed steel for the specific material to be cut is specified by our experienced engineering staff.

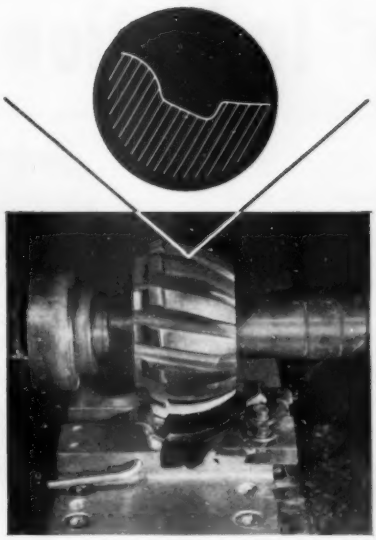
Barber-Colman form-relieved cutters require no "spot sharpening". Accurate face sharpening will maintain the correct form for the life of the cutter. This is true on all cutters including those with axial relief, rake or helical flutes.

Application of Axial Relief

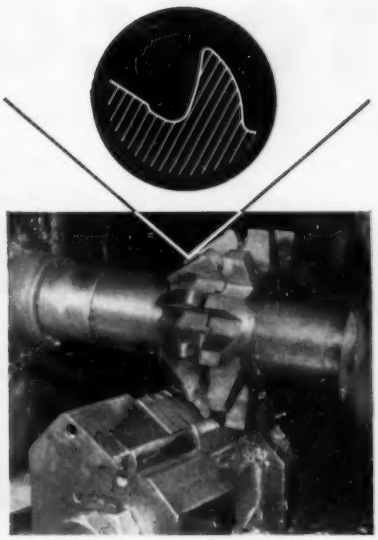
Surfaces which are in a plane perpendicular to the axis of the cutter, or nearly perpendicular, cannot be milled with a form-relieved cutter unless the cutter teeth are provided with axial side clearance. Barber-Colman can solve this problem by making the cutter with axial relief in one or both directions so that several cuts can be combined into a single milling operation. These applications show the proper use of axial clearance and helical flutes.



The form on this part has one side which is nearly perpendicular to the axis of the cutter, requiring a cutter with axial relief as well as radial relief. Both the axial and radial relief are formed onto the cutter tooth at the same time, and they are both applied to the complete tooth form. Consequently, the faces of the teeth can be sharpened without changing the tooth form. Helical flutes are provided to produce a shearing cut for improved finish and cutter life.



The form on this cutter is provided with both radial and axial relief because one small section of the form is nearly perpendicular to the cutter axis. Without axial relief, the perpendicular portion of the form would wear rapidly because of insufficient clearance. However, since the entire form has ample clearance behind the cutting edge, cutter life is greatly improved. Helical flutes eliminate any chatter during the cutting operation.



The workpiece in this application is tipped at an angle so that there is no undercut portion in relation to the axis of the cutter. However, in its cutting position, both sides of the form are nearly perpendicular to the cutter axis. The cutter is a two-piece interlocking type with axial relief in one direction on one side of the form, and in the other direction on the other side of the form. As the cutter is sharpened the form spreads apart, but the correct shape of the form is maintained. The proper dimensional relationship between the form is maintained by simply grinding the spacer between the two sections to the proper thickness.

These are only a few examples of the many special cutter problems passing through our Engineering Department daily. We welcome the opportunity to work with you in solving your production problems, and we invite you to send us part prints. Get top cutting efficiency through top cutter design.

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7 WAYS to SAVE MONEY with TOCCO* Induction Hardening



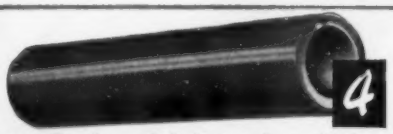
Cost was reduced 94% when heat-treatment of this corn-harvester part was changed from carburizing to TOCCO-hardening, 9½c saved on every piece — $4750 on each 50,000 piece batch, plus an hourly production increase from 120 to 300 pieces per hour.



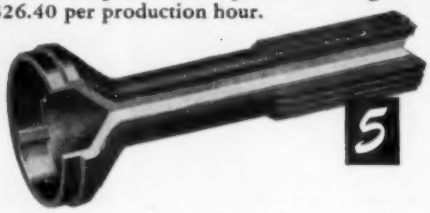
Leading automotive companies need and use TOCCO hardened axle shafts to handle higher horsepower. Better, yet cheaper—savings of $375.00 per day. Less machining costs, lower priced material, increased production, and a plus in quality—200% greater torsional life.



Kearney & Trecker Corp. reduced the cost of hardening this milling machine part from $1.57 to 10c apiece. In addition TOCCO made possible a switch from alloy to S.A.E. 1045 steel—saving another 11c per piece in material cost. Kearney & Trecker hardens 140 different parts on one TOCCO unit.



Thompson Products Ltd. boosted production of these automotive wrist pins from 500 to 1200 per hour when they switched to TOCCO-hardening. Costs fell from $5.45 to $3.25 per hundred parts—a savings of 2c per pin, $26.40 per production hour.



Mechanics Universal Joint Division of Borg-Warner reports a 69% savings in the hardening of stub ends for propeller shafts. TOCCO also upped production from 35 to 112 parts per hour—over three times as fast as conventional heating methods.

Lima-Hamilton Corporation adopted TOCCO for hardening this shifting lever. Results: a savings of 4c per piece—$25 per production hour. TOCCO costs only 17% of former heating method. This is only 1 of 139 parts TOCCO-hardened by Lima-Hamilton Corp. All show savings over usual heating methods.



7 Number 7—the lucky number—is up to you. Why not add your name to the list of companies who use TOCCO Induction Heating to increase production, improve products and lower costs. TOCCO engineers are ready to survey your plant for similar cost-saving results—without obligation, of course.

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The Tool Engineer

Plant the Seeds Early

Many words have been written decrying the teaching policies currently used in elementary and secondary education. These policies have been responsible for producing poor readers and individuals having little more than a nodding acquaintance with American history. Little if anything is being done to correct another defect in the educational system which, to my way of thinking, is of far greater importance to these United States, since it probably contributes to the present shortage of scientists and engineers more than any other factor. This is the lack of emphasis on science and mathematics in our high schools.

To insure an adequate supply of scientists and engineers we must begin attracting students to the field at an early age—but the trend is in the opposite direction. Surely without science and mathematics courses students can neither become interested in the field nor can they qualify for it. Our high schools are responsible, since half of them no longer teach physics or chemistry and, although algebra is taught, less than one quarter of the students take it. By the time students reach college it is too late.

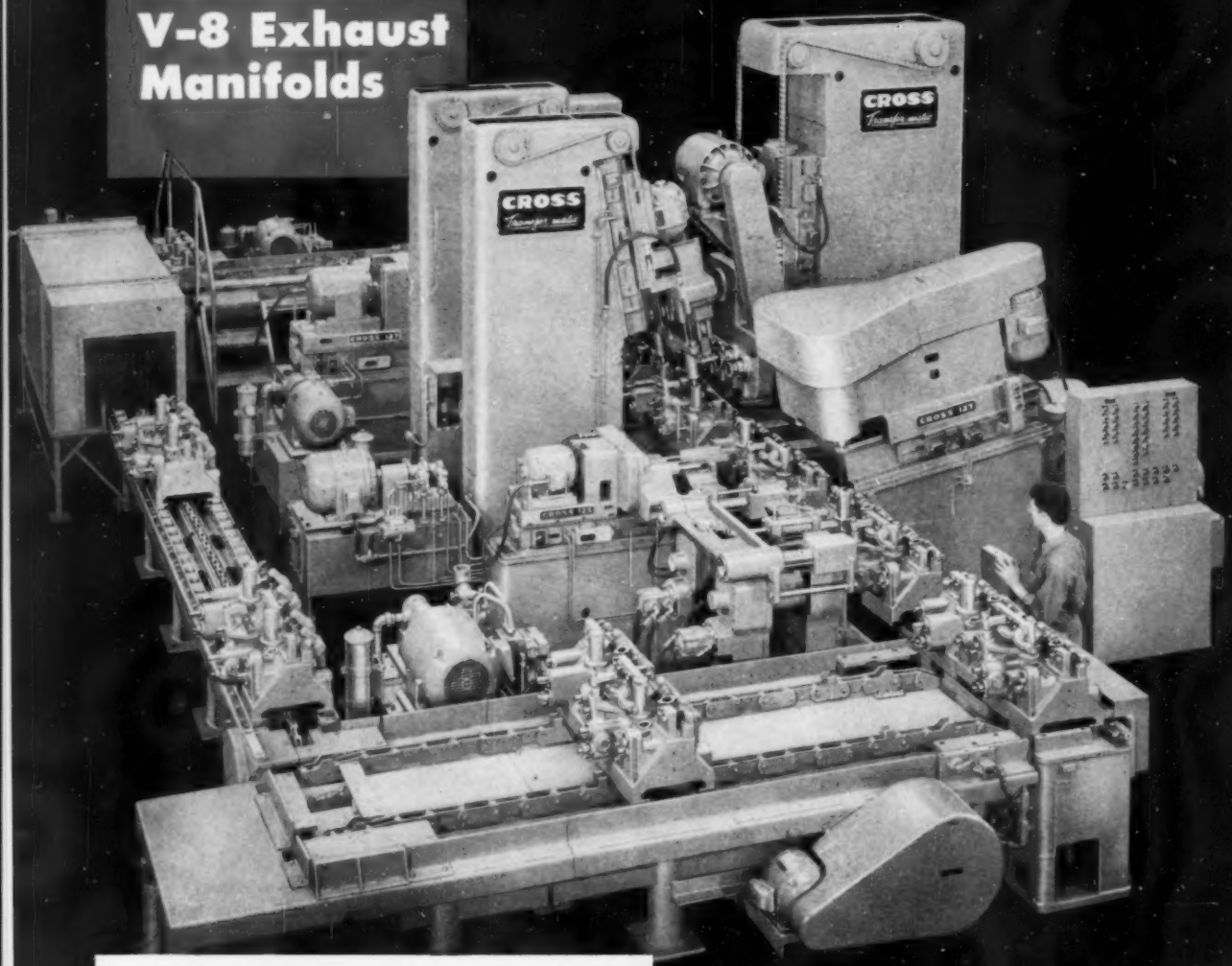
Our local boards of education, parent-teacher associations and teachers must be alerted to this fault in our educational system. As a parting word from your National President I urge you to do something about it. Your community must be made to recognize the need for solving this problem. Through your ASTE chapter or as an individual citizen you should make yourself heard.

H. B. Osborn Jr.

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TRAINING AND DEVELOPMENT *of tool engineers*

By O. W. Boston*

Professor Production Engineering
University of Michigan
Ann Arbor, Mich.

LATELY, MUCH ATTENTION is being focused on the subject of engineering curricula. Should specialized programs such as aeronautical, transportation, industrial and others be continued? Or should professional work be retained for graduates and a single curricullum of courses devoted to basic sciences, engineering science and the humanities be planned for undergraduates? There is a strong movement at this time toward this latter plan.

Question of Courses

Committee on Evaluation of Engineering Education of the American Society of Engineering Education has set up a "time distribution" for scientifically oriented curricula for experimental purposes. This plan calls for the following:

1. Humanistic and social studies—⅛ of the subject matter
2. Mathematics, physics and chemistry, basic sciences—about ¼
3. Engineering science—about ¼
4. Major departmental sequence of analysis, design and engineering systems, including necessary technological backgrounds—about ¼ .
5. Choices of the following options or electives—about 1/10
   - Humanistic—social science
   - Basic science
   - Engineering science
   - Research or thesis
   - Engineering analysis and design
   - Management

This is a four-year curriculum with a common freshman year or common first two years if feasible. The committee recommends that revised curricula should expand offerings in basic science, engineering science, humanities and social studies. Emphasis should be given to instruction in engineering science and its proficient application to analysis and design in engineering. An engineering science, by definition, involves largely the study of basic scientific principles as related to and interrelated with engineering problems and situations.

Economics, cost, and processes and equipment are subjects with which mechanical, industrial, production and tool engineers must be familiar. Pure and applied sciences are not static, and any course or curriculum revision should reflect their progress. Engineering is an applied science and yet a thorough understanding of the pure sciences is required.

There are various grades of technically trained personnel, such as the scientist, the engineer and the technician. Specifically, the scientist wants to know why things happen—what basic laws govern phenomena. He develops theories to interpret past experiments or predict results of future ones. He may devise new methods and theories for conducting and measuring his experiments. Frequently, a scientist works with engineers in the early stages of practical development.

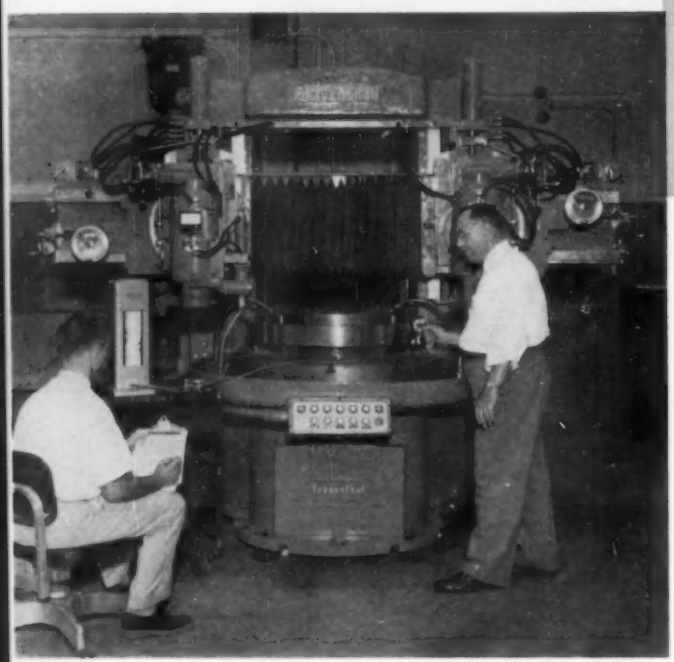
The engineer has an active curiosity about why things work and how to make them operate. He

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***Senior Member ASTE Ann Arbor Area Chapter**

Abstracted from paper 24T40, "The Training and Development of Tool Engineers," presented at the 24th ASTE Annual Meeting. Copies of the complete paper are available for purchase from Society headquarters.





Machine tool lab (above) at the University of Michigan where production and mechanical engineering students learn fudamentals of metal cutting.

Consultant work for industry (left), a part of student's training, may include determining performance of new equipment. Ring is being ground to tolerances on all dimensions within 20 millionths inch.

visualizes ways of putting new knowledge to use. The engineer must be cost conscious which particularly distinguishes him from the scientist.

The technician usually does not have a complete engineering education in the advanced phases of sciences, technical subjects and economics. He is concerned with how machines work and their operation. He may fulfill certain basic requirements such as prepare drawings, test machines, compile statistics, etc.

Engineering training should prepare the student to understand the basic and applied sciences as well as help develop him to take his place in society. The university alone cannot do this job completely. It must have the help of the home, schools, churches and public prior to his graduation, and the controlled training and guidance of industry afterward. The student should take an interest in the development of basic laws of science and the application of these laws. He should be interested in the design, manufacture and application or maintenance of equipment to aid in these studies and in the application of their results.

This is not necessarily completed by a four or five-year college course. It should continue as graduate study, adult education, or self-study and reading until full professional status is reached. Students in increasing numbers recognize limitations of their college work or become interested in subjects not studied and continue with graduate work leading to a master's, professional or doctor's degree.

The terms "manufacturing," "production," "industrial" and "tool engineering" are used differently by various groups and individuals. Production engineering in England is defined to be practically identical with tool engineering in this country. The American Society of Tool Engineers has defined tool engineering specifically and in great detail.

Courses in production engineering at the University of Michigan are the result of thirty-five years' development and began with shop courses to coordinate product design, metallurgy and production. As an exception to the general rule, this work was carried on outside of mechanical engineering in production engineering.

The production engineering option of the industrial engineering curriculum is intended to meet the needs of those students primarily interested in the methods and operations of manufacture. It includes the development, operation and control of processes, such as casting, forging, rolling, die-casting, stamping, welding, molding and machining. It is concerned with such functions as design for production, parts routing and equipment layout, and methods of manufacture; with jig, fixture, gage, tool, machine-tool and die design; and with technical estimating and inspection. The objective is to acquaint the student with principles and methods of fabricating materials.

The production option obviously is related more directly to the technical aspects of materials, equipment and application of methods of manufacture. Students under this option also may choose electives from among the metallurgical, mechanical, physics, chemistry, mathematics and economics departments, and the school of business administration. Graduate work leading to the degree of Master of Science in Engineering, and the doctorate is available.

Wide Range of Opportunity

This curriculum, chiefly scientific in content, is designed to provide the manufacturing industry with men equipped with a scientific foundation, who are familiar with materials, tools, processes and machines. With a short training period in the smaller companies, these men will be of immediate value. Large companies have one or two-year training periods to accommodate students employed each year from a number of schools with widely different types of curricula. Some large companies report that the specialization in engineering is of no particular value to them. They, of course, have a great variety of positions in which to place trainees. Statistics show, however, that the majority of the technical graduates go with the smaller companies.

Design for production, research and development, processing of parts, selection and design of machines, and cost estimating are promising fields, with supervision and management as likely goals. The welding, foundry, stamping, forging and plastic industries, the tool and die shops, parts-manufacturing and those making instruments for measuring and inspection, offer a limitless field for scientists and production engineers.

Future of Engineering Training

This program is the result of an effort to provide trained engineers for the metalworking industries. Industry has helped in this development over the years by offering many suggestions. The greatest problem has not been in satisfying industry with this program but in selling it to the University. The University organization has not encouraged it, and industry, while invariably enthusiastic when learning of the work, has done little to actively support it. Schools welcome suggestions from industry but these should be given to the president or dean as they are the ones most likely to initiate new policies or changes.

Students in production engineering are not "pure theorists" but do have a good training in the basic sciences and a number of courses of an applied nature which should give them immediate usefulness in the industry referred to. It must be remembered that a student can elect only a few of the advanced technical courses offered. Not many students, up to the time of their graduation, have the slightest idea of the nature of the work they will be engaged in.

During their last few months before graduation they have an opportunity to interview a number of company representatives visiting the university to hire graduates. The staff discusses these interviews later with the student to help him see clearly the fields before him. He often decides to take employment with a company of which he has little or no knowledge, involving a type of work passed by entirely in his studies.



Welding lab affords students practice in another of the basic industrial processes, with a variety of equipment including flame cutting, resistance, and atomic hydrogen machines.

This is where his training in the basic sciences helps him most. He is better able to adapt himself to the new situation. Many times, an engineer with one degree of specialization, such as mechanical, is engaged in work of another type, in but a few years after graduation. This occurs more often than is realized. Probably one of the most valuable characteristics learned in school is that of having an open mind about every new problem confronted.

Shortage of Students

For several years there has been a shortage of engineering graduates, based on industrial requirements, which are increasing.

The shortage is due primarily to the scarcity of students coming from high school prepared to study engineering. The number of students in high school is greater but the courses are more numerous and fewer are required in the sciences and other pre-engineering subjects.

Data published recently by the American Physics Society indicates that the percentage of students studying mathematics and science in the secondary schools has dropped from approximately 25 percent in 1900 to less than 4 percent in 1954. Thus, a large percentage of high school graduates have been led away from the scientific courses and are not interested in making up this deficiency in order to enroll in an engineering curriculum.

The National Office of Selective Service recently advised that this lack of scientific training in the elementary schools is of the greatest concern to them in regard to an adequate supply of engineers for national safety. Often social sciences replace the physical sciences. This seems to be the line of least resistance for the majority of high school students. It is little wonder that they are not interested in studying engineering in college!

Colleges should take a greater interest in high school training. Bulletins are sent to secondary schools by most colleges but the greatest influence seems to result from sports, music, the arts and the like.

If industry is to have more graduates in engineering, it should encourage more students to enter the field by offering information, such as case studies, to show young people what engineering is and what engineers do. Some scholarships are now being provided by technical societies, associations, individuals and industry. Much more effective help in the form of scholarships and publicity is needed from industry.

What characteristics are desired by industry in the graduating engineer, in addition to the technical training? Often mentioned is the need for ability to express, clearly and concisely, one's ideas both orally and in writing. Report writing is a necessity. A familiarity with economics, politics, history, literature, music and sport is desirable. Moral integrity, dignity, personality, neatness, poise and respect for others are fundamental requirements. Leadership, ability to work with others and extra-curricular activities are stressed. Scholarship is, of course, invariably at the head of the list.

Many of the personal characteristics are beyond the normal scope of university or college training, although efforts in many directions are made to improve the desirable characteristics and discourage others. In addition to the control and example of the instructor, there are available speech societies, student branches of national engineering societies.

These include ASME, ASTE, ASM, AFS and SAE, all of which have programs, prepared by the students themselves with the help of the faculty, with local and outside speakers. Social gatherings, plant trips and movies on engineering developments are other methods for giving the student a better understanding of his work and position. Many work on student publications or are associated with fraternities and honorary societies, all of which, as extra-curricular activities, consume most of their free time. The university is most anxious to train the student in every way possible to fit him best for his life work and the cooperation of industry is most welcome.



Determining the mechanical properties of metal in engineering materials and processes course, which is required of all freshman engineers.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Fixture for Sawing U-Slots

This fixture is designed for producing U-slots in flanges. When slots have not been cast or forged integral with the piece, sawing from a drilled hole is usually less expensive than other methods, especially for small quantities. This type of fixture provides a guide for sawing and produces a U-slot of a quality satisfactory for most classes of work. No layout is required, location being made by the fixture with reference to the drilled holes.

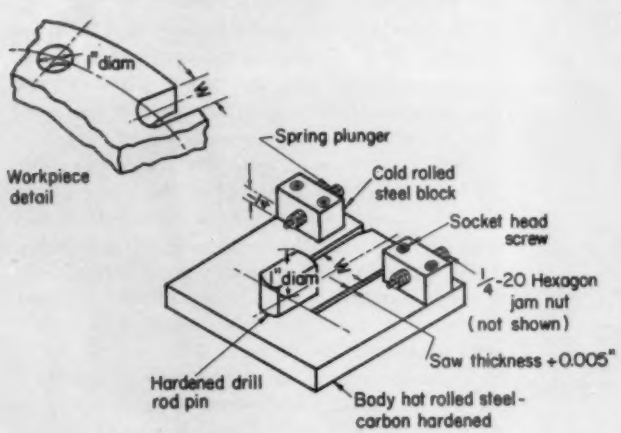
A fixture of this type designed for saw-cutting 1-inch slots in a circular steel plate flange is shown in the accompanying sketch. The flange has been predrilled with 1-inch diam. bolt holes. The fixture body is a piece of 3/8 x 3 x 3-inch hot rolled steel. Two saw guide slots are cut in the body; the *W* dimension is equal to the width of the desired slot. The saw guide slots are approximately 0.005 inch wider than the thickness of the saw blade to provide clearance and are of equal length. The closed ends of the slots establish the center line of the slot on the fixture body.

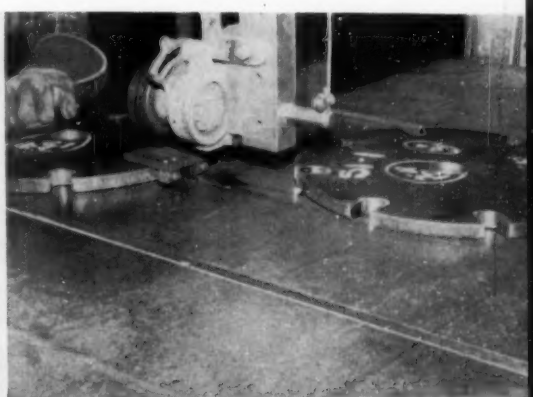
On this center line a hardened drill rod locating pin is press-fitted into the body. Sides of the pin are removed to provide ease of fitting in the flange hole as well as saw clearance. The fixture is centered and held in position on the workpiece by two spring-loaded plungers. Such plungers are standard fixture components. Each is capable of exerting a maximum end pressure of 8 lb. The plungers are mounted in a 1/4-20 tapped hole in each 1/2x1/2x7/8-inch cold rolled steel block. These blocks are mounted on the fixture body with socket head screws. Hexagonal jam nuts are used to lock the plungers in position. The fixture body is case hardened before assembly.

For use, the fixture is snapped in position on the workpiece by inserting the locating pin in the drilled hole. Equal pressure by the spring plungers centers the saw guide slots, therefore the plungers should be set the same distance from the center of the locating pin. The setup is shown in the accompanying photo.

As the second cut on a slot is completed, the cut section will break loose and the fixture is disengaged from the workpiece. A burr of about 1/32 inch results at the point of tangency of the saw cut and the center of the drilled hole. Since the width of most U-slots provides for 1/8-inch clearance over the bolt diameter, the burr is usually not objectional from a functional standpoint. It is readily removed when the edges of the slot are deburred.

Clement F. Brown
Willow Grove, Pa.





Special Arbor for Surface Grinder

Small shops are often faced with the necessity of doing an oversize job on small or medium capacity machine tools. The adaptor illustrated was designed and built to enable a shop to surface grind a quantity of cast-iron machine tables which are four inches wider than the transverse feeding movement of the grinder wheel head.

Essentially the device consists of an extension arbor held on the tapered end of the existing machine spindle. This arbor carries two grinding wheels instead of the conventional one. The wheels are separated by a sleeve spacer which is equal in length to the desired increase in width capacity, as shown.

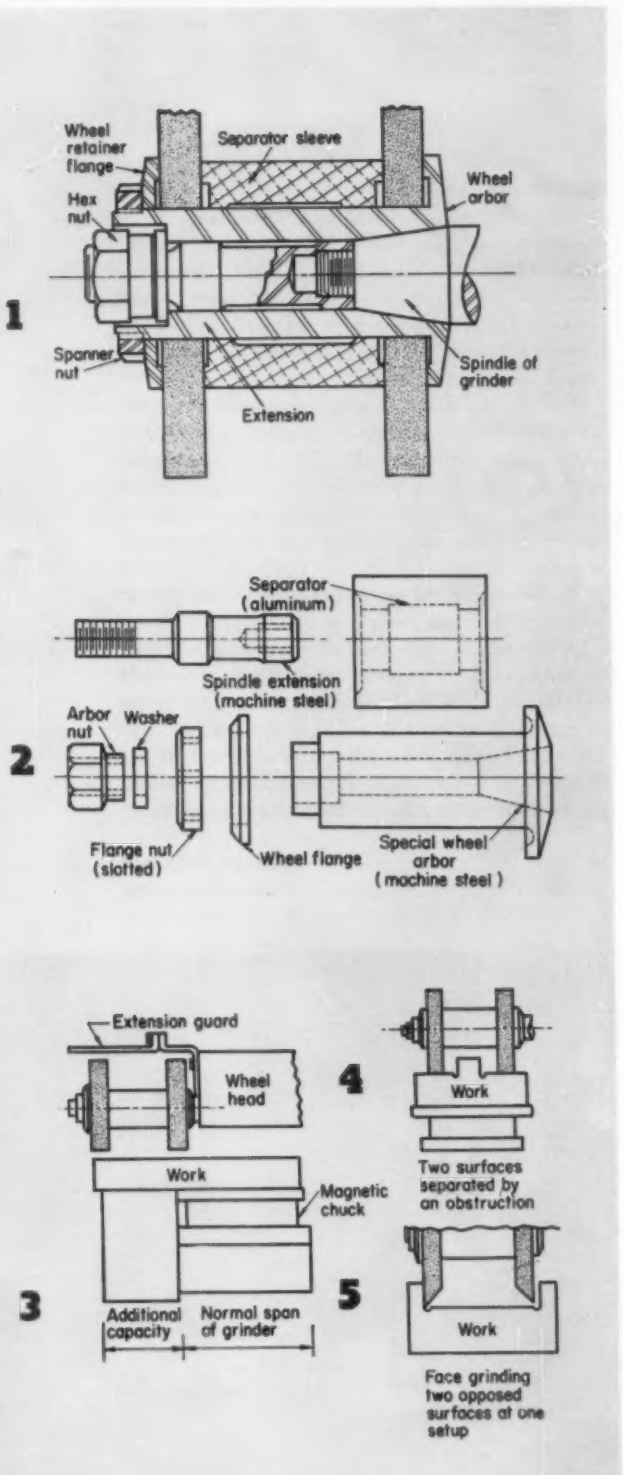
The complete assembly, sketch 1, consists of the following parts. An extension spindle is bored and threaded to screw snugly onto the threaded end of the grinder spindle. The outer end of this extension is externally threaded. A wheel arbor is bored to an internal taper to fit accurately on the tapered nose of the machine spindle. It is drawn tightly onto this taper and held by a hexagon nut which has been threaded onto the outer end of the extension. The two grinding wheels are fitted to the OD of the arbor and separated by the separator sleeve. This separator may be made of aluminum to reduce weight. The outer wheel is retained by a flange and spanner nut. Details of these parts are shown in sketch 2.

Both wheels must be trued together to exactly the same diameter if flat surfacing is being done, sketch 3. It is also advisable to use the freest cutting wheels possible in order to minimize radial pressure against the outboard wheel.

This device is also useful for several other types of jobs; sketch 4 shows how two surfaces, separated by an obstruction, may be ground simultaneously on one setup. These two surfaces do not necessarily have to be on a single plane as by truing the wheels to two diameters, surfaces on two planes may easily be finished. Sketch 5 shows how the face grinding of two opposed surfaces may be expedited. In this case the wheels should be recessed on their cutting sides and only one surface is ground at a time. The time saving is due to the small cross movement necessary to bring the other wheel into contact with the second face surface.

In the interests of safety it is wise to provide a simple sheet steel guard, which is made up as an extension to bolt to the guard support on the machine, as shown in sketch 3.

H. J. Gerber
Member-at-Large
Stillwater, Okla.



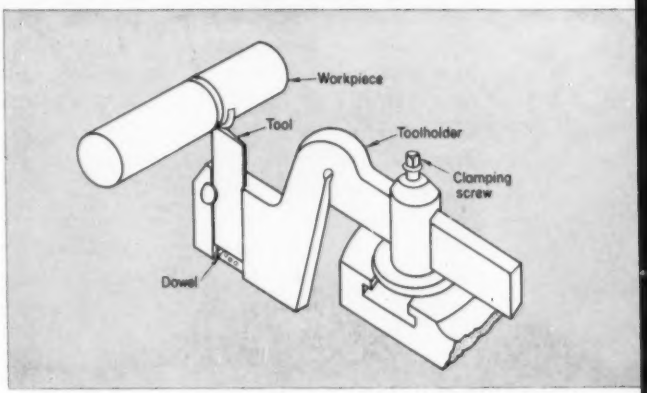
Gadgets

Nonchatter Toolholder

Lathes often develop play in the spindle and carriage, causing chatter and chipped cutoff tools. This chatter is difficult to avoid even with spring type toolholders. To prevent this and improve tool life a toolholder was designed and built which provides greater support to the cutting edge. This holder takes the standard type cutoff tool, turned up to a vertical position so it cuts on the end. Instead of jutting out like a cantilever beam, it is mounted like a column or post as shown in the accompanying sketch.

In this position the downward force of the cut is transmitted through the tool bit into the holder. This design eliminates the overhang and resultant bending of the tool. The toolholder is cut from a solid piece of steel with a slot milled in it to take the cutoff blade. The clamping screw is patterned after the screw used in the conventional toolholder. A series of dowel holes is reamed through the lower section, each row of holes being offset to provide a large number of settings.

A dowel in one of these holes backs up the tool and takes the vertical pressure. The dowel has a circular groove ground in it for the tool to rest in and prevent the tool from slipping out of the holder. The toolholder leans forward from vertical a small amount to provide the front clearance angle for cutting.

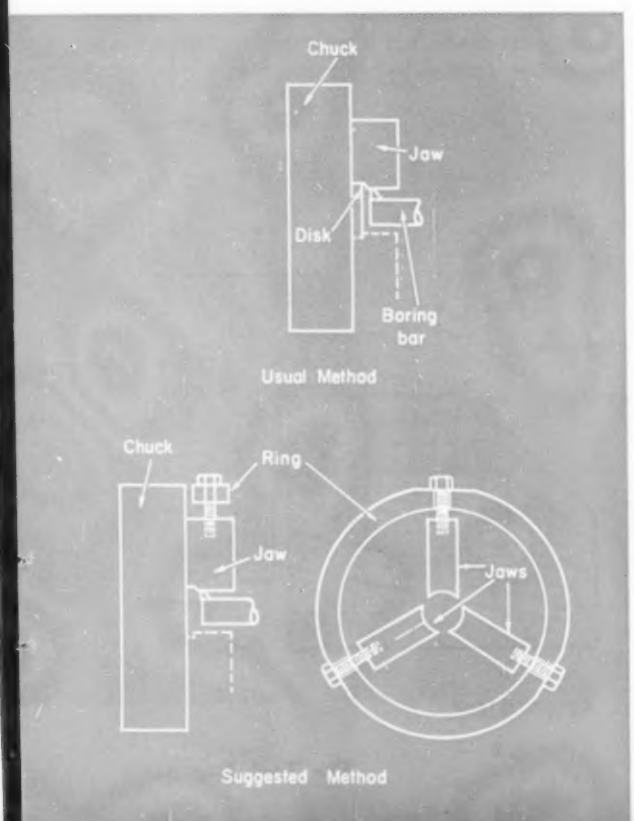


Ernest Jones
Bronx, N. Y.

Truing Chucks

When concentric chucks become worn it is difficult to true up the soft jaws, especially when wear between the teeth of jaw bases and the scroll plate causes play in the jaws. In the usual method for boring the jaws, a disk is clamped inside the jaws which are then bored to the required diameter. After this repair operation the jaws often fail to hold work true since, due to disk reaction at one end, the line of pressure is now different from that when the boring was performed.

To overcome this difficulty, a ring machined all over and having 3 flats index-milled as shown, is placed around the jaws. Bolts are passed through the flats and screwed in the jaws. The bolts are hand tightened with care so that there is an equal gap between the ring and each jaw. Next, the jaws are closed by turning in the chuck key. The strain thus created in the ring applies pressure to the jaws as usual, except that the line of pressure is at the center as when the jaws are gripping work. When jaws are bored in this way they will hold work true in spite of the fact that the chuck is worn.



M. W. Latchandani
Member at Large
Baroda, India

Ejector for Forming Die

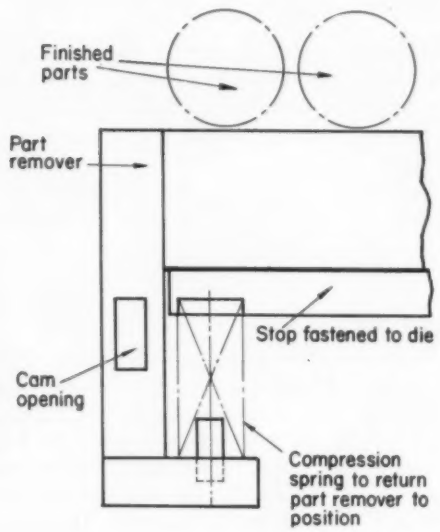
When an air blast cannot be used for ejecting parts from a die, a mechanical arrangement must be set up. Often such a device, designed for a specific application, can be adapted to a wide variety of situations. Cam operating principles incorporated in this die ejector are of this sort. The ejector was designed for a multiple production forming die.

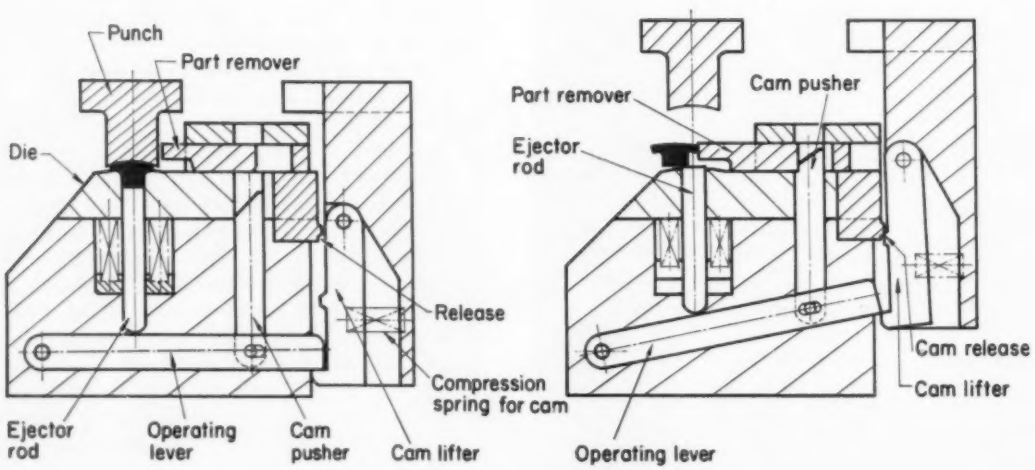
Although the device may appear complicated, its operation is relatively simple. Elements consist of a cam lifter, operating lever, cam pusher, part remover, ejector rod and cam release.

When the die is closed to form the part, both the ejector rod and cam pusher are recessed in the die base. As the punch is raised on the upstroke of the press the operating lever is raised simultaneously by the cam lifter. This lever lifts both the ejector rod and the cam pusher. The formed part is first ejected from the die. Then, as the cam pusher moves the part remover forward, the part is pushed off the die. The cam lifter continues to raise the operating lever until the release on the rear of the die forces the cam lifter back, releasing the operating lever. Both the cam pusher and ejector return to position, permitting loading of the next workpiece.

A compression spring holds the cam lifter in the forward position, except when releasing on the upstroke and latching on the downstroke. Likewise, springs shown in the plan view detail return the part remover to position. Since several parts are formed in the die at each stroke, separate ejector rods are provided for each part. A cam pusher at each end of the die is sufficient to operate the part remover bar, however. The edge on which the cam acts should have a radius and be hardened for smooth operation and to reduce wear.

G. Lateste
Montreal Chapter





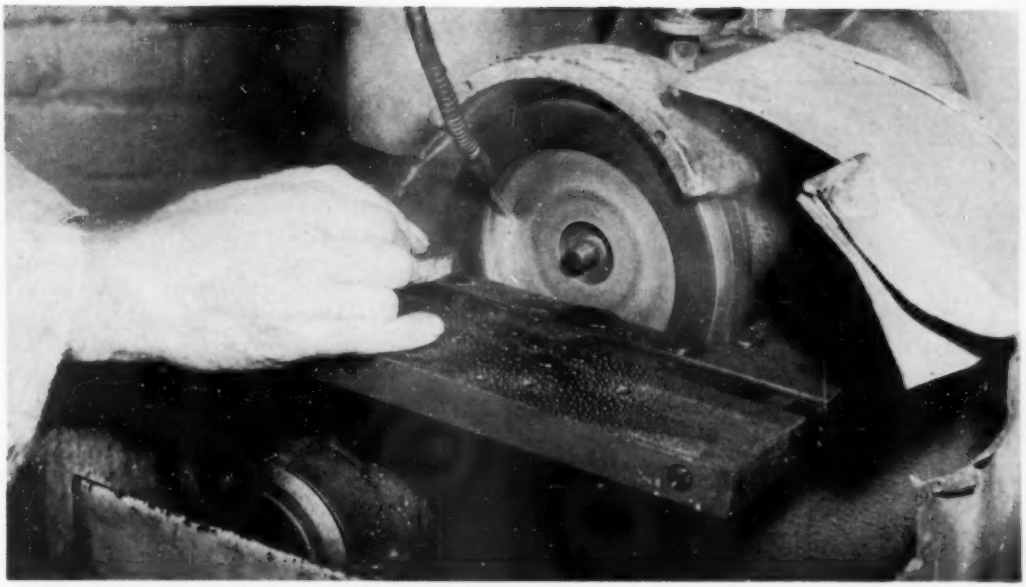


Fig. 1. High-pressure coolant jet penetrates the slip stream, created by high wheel speed, to provide adequate cooling. There must be a copious coolant flow, applied as shown or directly to the grinding face, or there is danger of cracking the carbide.

Faster Carbide Grinding

With Metal-Bonded Diamond Wheels

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WITH PROPER application, metal-bonded diamond wheels can profitably be used for some tungsten carbide grinding operations where resinoid or vitrified bonds have been accepted as standard. Metal-bonded wheels have not been used extensively because once their initial sharpness has been lost, high cutting rates have been unattainable without drastic reduction in wheel life. Since long service life is the most desirable characteristic of a metal-bonded diamond wheel, improved cutting rates at a sacrifice of life negates much of its advantage. To obtain satisfactory production rates, with a necessary balance between labor and tool costs, it has been considered more economical to use shorter-lived, high-cutting-rate wheels.

Experiments have recently been conducted to determine the effects of wheel speed on cutting rate for metal-bonded diamond wheels. Wheel speed was increased in steps and cutting rates were determined. Type D6WHC, 6-inch cup wheels were

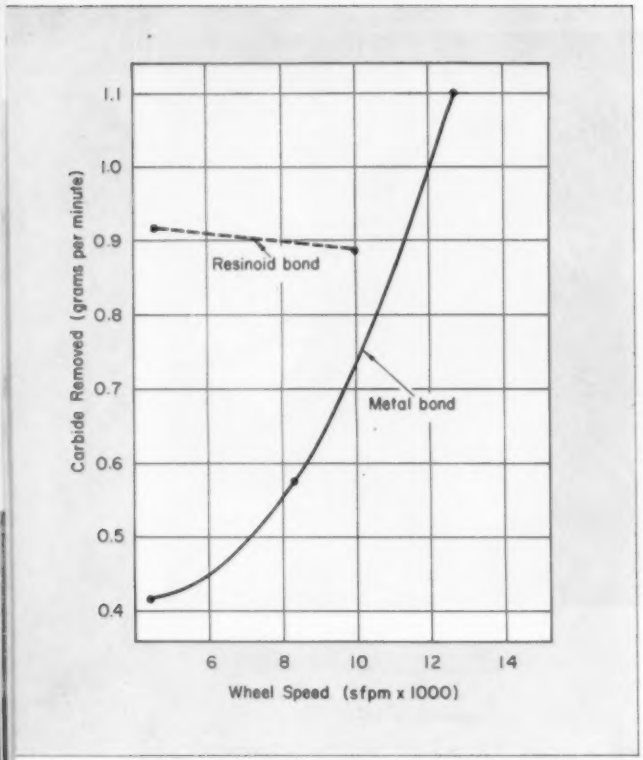


Fig. 2. Carbide removal rates plotted against wheel speeds for both resinoid and metal-bonded wheels. Type D6WHC cup wheels, 6 by ¾ by 1¼ inches, were used with water as a coolant.

used for offhand grinding of single-point tools. *Fig.* 1. Tools were ½-inch solid carbide rounds.

Results showed, *Fig.* 2, that the cutting rate improves rapidly with increased speed. In the range between 10,000 and 12,000 sfpm, metal-bonded wheels equal and surpass resinoid wheel removal rates. As was anticipated, generation of heat increases with higher speeds but coolant should be supplied in copious quantities. From the results achieved and in view of the safety factors involved, surface cutting speeds between 10,000 and 12,000 sfpm are the most practical.

No determination of wheel life was made during these tests. Such determinations would have greatly extended the tests and it is known from past experience that moderate increases in speed do not affect wheel life adversely. In fact, the reverse is usually true under ordinary conditions.

When metal-bonded diamond wheels are used at high speeds certain operating and mechanical factors should be considered. Because recommended wheel speeds are in excess of those usually used, wheels should be approved by the manufacturer prior to high-speed operation. Machine spindles and bearings must be capable of withstanding the increased speeds and loads. Machine and wheel balance, and dimensional accuracy are more important as speed increases.

More power is required for high-speed grinding. Merely changing motor pulleys results in an underpowered spindle in most instances. It is advisable, for example, to have at least a 1-hp motor on a 6-inch single-end grinder.

With a 100-grit wheel, surface finish ranged from 3 to 6 microinches, rms. It appears that finer grit wheels could not offer much opportunity for improvement.

During early stages of the tests, some difficulty was experienced in obtaining proper heat removal. At high speeds, an air slip-stream, *Fig.* 1, surrounds the wheel and blows the coolant stream away from the grinding contact area. It was found necessary to use higher coolant pressures in order to penetrate the slip stream.

A highly heat conductive liquid, such as a thin water-soluble oil or a detergent type coolant, should be used instead of straight oils, kerosene or similar materials. Because of the high pressures necessary to penetrate the slip stream, such devices as wick applicators and mist coolant systems are inadequate with high wheel speeds. With adequate coolant, no burning or checking of the carbide was encountered during the tests.

Where single-point tools are ground freehand on the side of a cup wheel, increased wheel speed can result in the cutting rate of a resinoid-bonded wheel and the life of a metal-bonded wheel. Present users of resinoid-bonded wheels, for example, can expect up to 90 percent reduction in wheel costs. Even though many factors affect wheel life in the shop, it seems reasonable to presume that at least half of the possible savings can be realized.

Investment Casting Extends Impeller Life

Protection of its stainless steel pump impellers against corrosive attack has led to investment casting of parts by Eco Engineering Co. Consequently, the pumps have a greatly extended life in corrosive service, thus providing multiple savings. They resist corrosion from three to five times longer than the previously used impellers which were produced by other methods. Primarily, the increased resistance appears to be due to smoother surface finish obtainable in investment casting. This seems especially true in areas where finishing by grinding presents unusual difficulties.

In addition, the smoother surfaces lessen friction loss and allow faster fluid flow.

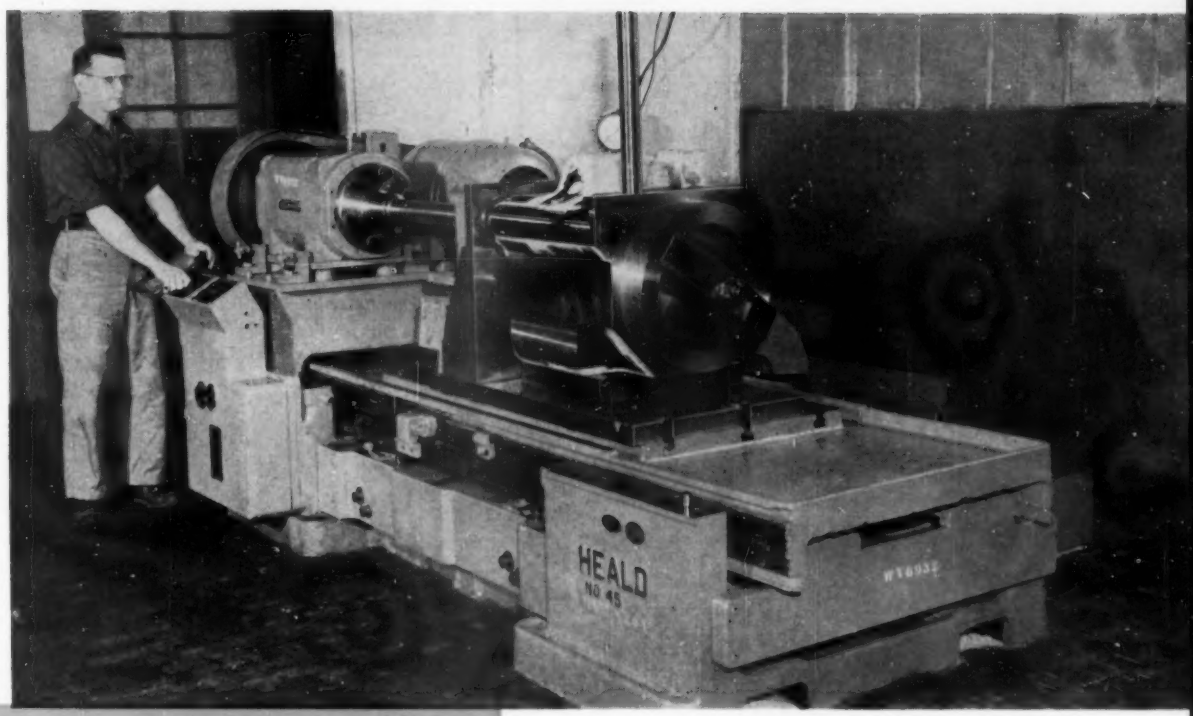


Fig. 1. Experimental setup after successfully trepanning spring case hole to a semifinished diameter of 3¼ inches.

TREPANNING a development case study

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To develop specifications for a machine, tools and operating techniques that would efficiently trepan large, deep holes with a rotating tool and a stationary workpiece, required basic tool engineering research. This article traces the development steps, indicates the thinking that preceded each change in design and lists the results obtained.

DIFFICULTIES in drilling deep holes of large diameter in a solid, steel irregularly shaped workpiece by conventional spade or twist drills prompted Watervliet to investigate alternate methods. Trepanning was one of the processes investigated because of high penetration rate, good surface finish, straight holes and long tool life. Although it has been necessary to rotate the otherwise stationary cutting tool, trepanning has proved successful in the test application, *Fig.* 1, and will probably be used for finishing operations in the future.

Workpiece for these experiments was the breech ring for a 120-mm field piece. It is necessary to

*Senior member ASTE Hendrick Hudson Chapter.

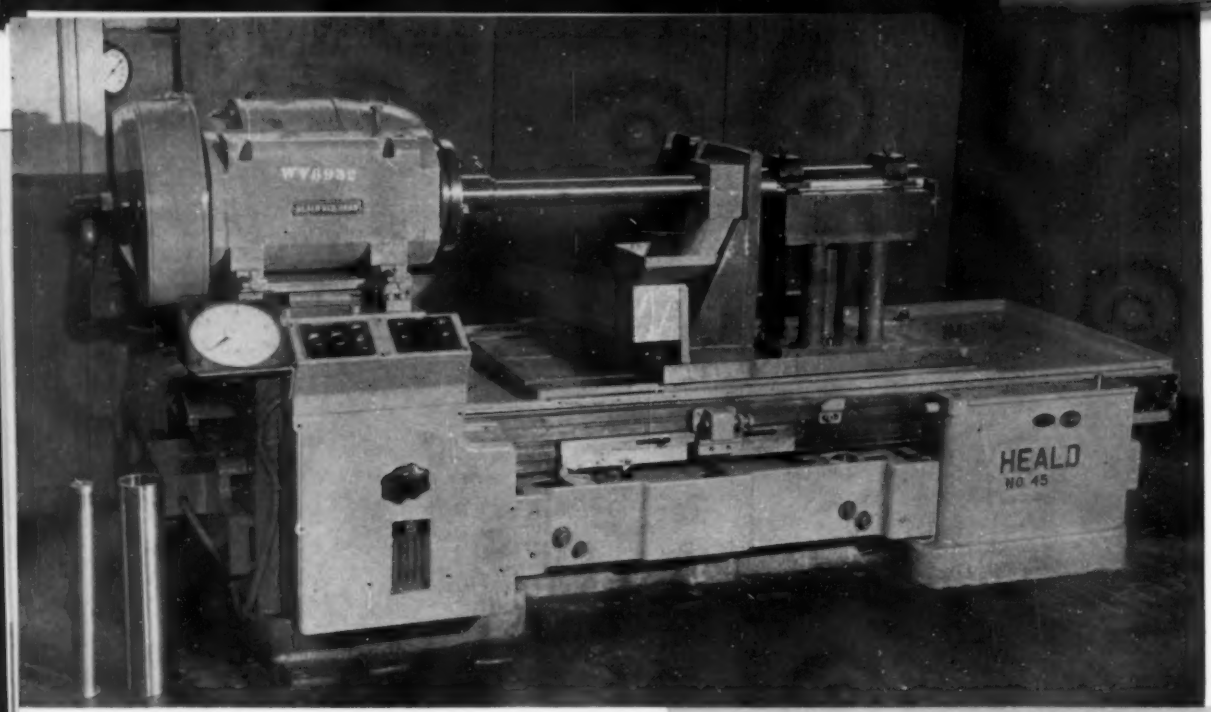


Fig. 2. (above) Cylindrical pieces were used for initial tests by adding a pedestal and V-block to the breech ring fixture. Sheet metal forms to left of fixture control coolant and chip discharge.

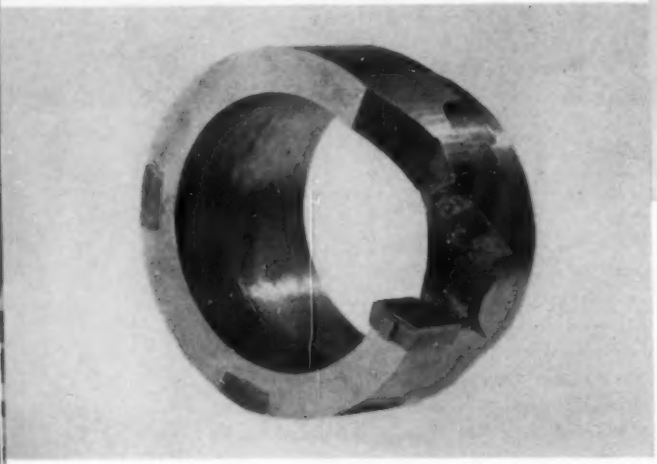


Fig. 3. (left) Type I trepanning head contains brazed carbide tool with a triple edge.

produce a 20-inch deep hole through this ring for the spring case. This hole has a semifinished diameter of 3¼ inches. In order to expedite the tests and avoid possible damage to expensive breech rings, initial testing was performed on round test pieces of the correct length, *Fig.* 2.

A precision boring machine, No. 45 Heald, was selected for these experiments because it required a minimum of conversion for trepanning with a rotating head. Initial tooling comprised an adapter bolted to the machine spindle, a drive tube that fit into the adapter and a removable trepanning head with brazed-on carbide tool and carbide wear pads. The breech ring holding fixture was designed to contain a slip bushing that fit securely against the workpiece. This bushing guides the trepanning head to its proper starting point and controls the escape of coolant, which is under high pressure to properly flush the chips and prevent binding of the head in the work.

Conventional nonrotating heads have elliptical inside diameters so that coolant entering through an oil gland around the outside of the drive tube and head forces the resulting chips out between the core and inside diameter of the drive tube. Such an elliptical shape necessitates the use of a wide tool, with resulting large power consumption, and would tend to unbalance a rotating head. To reduce the power required and because the head was to rotate it, it was determined that concentric inside and outside diameters would be desirable. Chip removal problems were avoided by milling a chip exit groove in the outside diameter of the head and undercutting a section of the outside diameter of the drive tube.

Coolant is forced through the spindle and drive tube, around the core and across the tool. Chips are carried out to a screened container in the coolant reservoir through a specially constructed splash guard, *Fig.* 2.

The first head, *Fig.* 3, had two brazed carbide wear pads and a single brazed carbide tool. Diametral sizing was accomplished by cylindrical grinding after the head was mounted on a special

adapter. The cutting face was then formed into a triple edge to reduce chip width.

Eight tests were conducted with this head on test pieces of various lengths. Average conditions for this and subsequent tests are listed in TABLE 1. In all tests with the Type I head, tool and bar vibrations were excessive. The tool machined 0.010 inch oversize and tool wear was pronounced. The longest test piece trepanned was 7 inches in length.

This head design was considered unsatisfactory because excessive maintenance was necessary due to: tool breakage, which required the carbide tip to be replaced; excessive tool wear on the periphery, which also required replacement; and heat from brazing, which caused warpage of the head and pads, necessitating considerable rework.

On the basis of this experience, the Type II head was designed to accept a removable insert type tool, *Fig.* 4. The tool was located by means of a 90-deg V-shaped groove machined in the wall of the head. The tool was held in place by an 8-32 Allen screw that pulled the insert down into the V.

Tests with this tool on 7 inch long test pieces resulted in improved performance. Tests were continued with longer workpieces under the average conditions outlined in TABLE 1. Greatest length of penetration using this head was 21 inches. As compared with the Type I head, cutting action was steadier with a doubled feed rate, and vibration, although still present, was greatly reduced. Average resulting holes were 2.940 inches in diameter at the start, 2.945 at the finish and were 0.002 inch out of round.

Several defects were found in the Type II head. Periphery of the head opposite the carbide wear pads showed evidence of rubbing on the wall of the generated hole. The outside wall of the V-shaped tool pocket had spread, allowing the tool to loosen.

To circumvent the defects found with the Type II head, the Type III head was designed with additional wear pads, *Fig.* 5. To prevent loosening of the tool, the insert was countersunk instead of the head to retain the hold-down screw. A double-edge cutting tool was used to simplify construction and reduce tool maintenance.

Hole diameters in all 12 tests averaged 0.004 to 0.005 inch larger than the head diameter at the start of the hole and gradually increased to 0.010 to 0.015 inch oversize at the finish. Surfaces of the holes were highly burnished and surface finish averaged 8 to 10 microinches rms, due probably to the pressure and action of the wear pads. Tools were dull after 20 inches of penetration and in two tests failed at 17 and 18 inches. The double-edge tool, although simple in construction, increased vibration during the cut and was considered unsatisfactory.

For the next series of tests, the double-edge tool was replaced by a triple-edge tool in the Type III head and trepanning was done on breech rings. Nine test cuts resulted in high similarity. Hole diameter exceeded the head diameter by 0.006 inch in only one instance while all other holes were within 0.002 inch. All holes ranged from 0.002 to 0.003 inch out of round. Exit ends of the holes averaged 0.017 inch off location horizontally and 0.004 inch off vertically. Tool life was good. One tool machined 5 holes, 100 inches, before requiring resharpening. Wear pads above the center line proved to be unnecessary and, since they might lead to seizure of the head if considerable wear oc-

Fig. 4. Removable carbide insert is held in V-shaped pocket in Type II trepanning head.



Table 1—Trepanning Head Characteristics and Test Conditions

Experimental Trepanning Head	Head Diam. (inches)	Carbide Tip (grade)	Edges On Tool (No.)	—Chipbreakers— Depth (inch)	Width (inch)	Spindle Speed (rpm)	Cutting Speed (sfpm)	—Feed— (ipr)	(ipm)	Coolant Pressure (psi)	Workpiece Hardness (Bhn)
Type I	2.937	Carboloy 78	3	0.012	0.060	240	185	0.0020	0.480	100	300*
Type II	2.938	Carboloy 78	3	0.010	0.030	240	185	0.0040	0.960	100	300*
Type III	2.949	Carboloy 78	2	0.015	0.045	240	185	0.0050	1.200	100	300*
Type III	2.949	Carboloy 78	3	0.015	0.045	240	185	0.0045	1.000	100	300†
Type IV	3.250	Firth 416A	3	0.015	0.050	240	205	0.0050	1 3/16	100	300†

*FS 4340 test piece. †120-mm breech ring.

curred on the periphery of the tool, it was deemed advisable not to have too many. A certain amount of redesign was necessary because the Type III head tended to loosen on the drive tube because of vibration.

Based on accumulated experience, the Type IV head was designed with a diameter of 3.250 inches, the semifinished diameter of the spring case hole. The head and drive tube were redesigned for threaded assembly to prevent loosening. A triple-edge inserted type tool was retained. Removable wear pads were incorporated to lower maintenance costs and wear pads were located below the center line to prevent possible seizure of the head due to peripheral tool wear.



Fig. 5. Redesigned Type III trepanning head with counterbore in insert rather than in head and triple cutting edge.

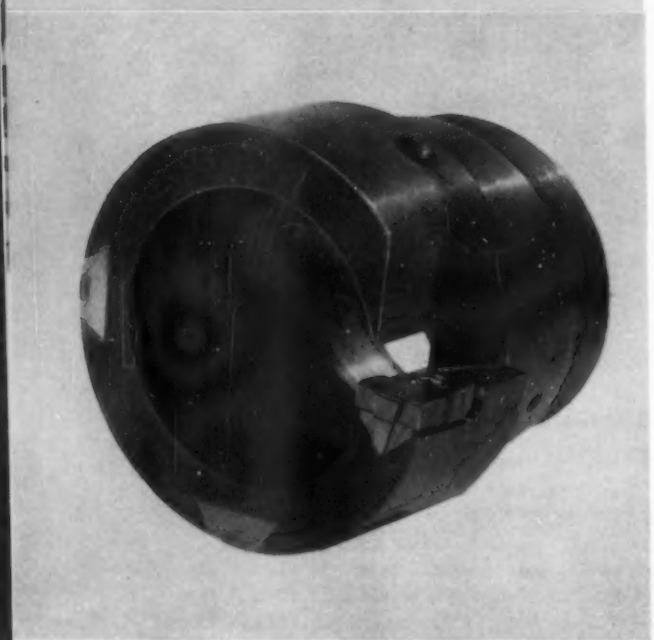


Fig. 6. Final design of trepanning head, Type IV, used inserted wear pads and was threaded into the drive tube.

In addition to the conditions listed in TABLE 1, three tests were run with the Type IV head with actual machining time, 18 minutes; finish of core and hole, 16 microinches, rms; power consumed during idle, 3hp, and power consumed during cut, 7 hp.

Actual test results are shown in TABLE 2. Replaceable wear pads showed no wear after 60 inches of penetration. One tool was used to perform the three tests without necessity of sharpening. This represents removal of approximately 75 pounds of chips. Tool vibration was low but power consumption was 2 hp more than the rated capacity of the motor.

The purpose of this experimental program, to develop specifications for a machine and related tooling, was accomplished successfully. If the 5-hp motor was replaced with a 10-hp motor, power would be adequate for trepanning spring case holes to semifinished diameters of 3.250 inches on a production basis. Production of these holes by trepanning would reduce machining costs, compared to drilling, by 83 percent, and tool maintenance costs by 57 percent, TABLE III.

Based on the experience gained from these tests with converted equipment, it is presumed that such holes can be produced to finished size by trepanning on equipment specifically designed for the purpose. Since such trepanning is presently limited to holes larger than 1½ inches in diameter, these procedures will be used only for large diameter, deep, through holes.

Table 2—Results of Trepanning with Type IV Head

Test No.)	Head Diam. (inches)	—Hole Diameter— Start (inches)	Finish (inches)	——Runout—— Horizontal (inch)	Vertical (inch)
1	3.250	3.252-3.254	3.254-3.257	0.017	0.003
2	3.250	3.252-3.254	3.254-3.256	0.005	0.002
3	3.250	3.251-3.252	3.254-3.256	0.008	0.002

Table 3—Comparison of Hole Production Costs

Operation	——Time—— Drill (hours)	Trepan (hour)
Twist drill 1½ inch lead hole	1.50	—
Spade drill 3¼ inch hole	2.81	—
Trepan 3¼ inch hole	—	0.75
Resharpen tools, per hole	0.58	0.25

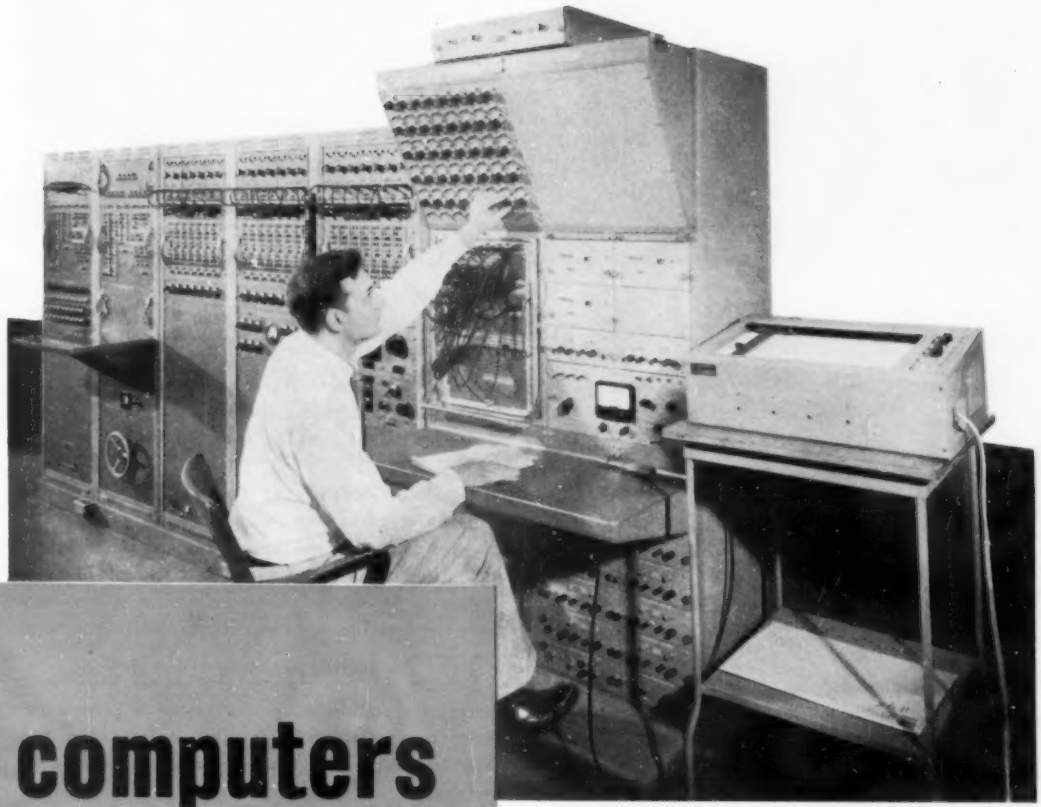


Fig. 1. Operational analog computing facility, used for the study of problems involving physical systems, such as electrical networks.

computers for machine tool control

By J. J. Stone

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TECHNIQUES AND METHODS for controlling machine tools by means of automatic computers have been developed to the point where they are being applied to production. Computer-controlled machines are making more and more operations automatic. In order that the impact of this technology may be intelligently evaluated, it is essential that the operating principles of computers be understood. Despite their complex appearance, automatic computing machines are based on simple logic. They are not able to "think" in any sense. They merely perform, at great speed, fundamental operations prescribed by the machine operator.

Classification of Computers: Computers are either analog, *Fig.* 1, or digital, depending on the form and nature of the information handled. The difference between the two types of information is illustrated in *Fig.* 2. Continuous variable information can be represented by a curve as shown on the chart at the left.

Abstracted from paper 24T25, "Introducing Computers for Machine Tool Control," presented at the 24th ASTE Annual Meeting. Copies of the complete paper are available for purchase from Society headquarters.



Fig. 2. Comparison of analog and digital type data. The continuous (analog) curve at the left can be regarded as being made up of an infinite number of points. The stepped (digital) curve at the right is made up of a finite number of points.

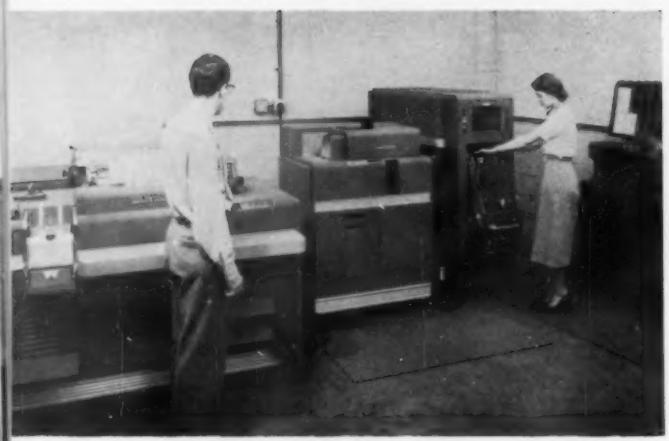


Fig. 3. Typical digital computing facility. Although the equipment appears complex, the operations performed are simple.

The chart depicts one way in which variation in the length of a line car be represented. The length of a line representing the dimension of a part may be said to be continuously variable and is independent of any numerical system of measurement.

In actual practice, however, dimensions on a blueprint are indicated by numbers which refer to units in a system of measurement, such as inches. In the chart on the right, the smallest unit of measurement is one hundredth of an inch. The representation of changes in dimension proceeds in a series of distinct steps. The size of the steps can be made smaller, such as one thousandth of an inch, but in any event the steps are discrete variables.

Analog computers handle information in continuous variable form, while digital computers handle information in discrete variable form. In an analog computer, the magnitude of a single quantity such as a voltage or current represents the magnitude of a single piece of information which is being operated upon. An increase in the voltage, for instance, represents an increase in quantity. This increase, not being in a specific numerical unit of measurement, is in the form of a continuous variable.

Voltages and currents in a digital computer, on the other hand, are either on or off and do not in themselves represent the magnitude of a quantity. Instead, a combination of "on" and "off" is used to represent the quantity being operated upon.

Analog Computers: The name analog comes from the word analogy, which implies a relation of likeness between two things. The earliest form of analog computer was simply a model of a physical system to be studied. Later, electrical components were employed to represent mechanical elements of the system.

Because of the likeness that exists between a system and its model, a relationship is present between the variables in the full scale system and those in the model. These are generally continuous variables.

There are two basic types of analog computers. The first of these is called the direct analog. A direct analogy exists between the electrical components of this type of computer and the physical system to be analyzed. In the case of a weight suspended by a spring, electrical inductance is equivalent to the inertia of the weight, electrical resistance is equivalent to the friction and electrical capacity is equivalent to the elasticity of the spring. These are the fixed elements of the physical system. Likewise, voltage is equivalent to force, current to velocity and total electrical charge to position.

Large direct analog facilities have been developed for the study of physical systems. Notable among these are the a-c network analyzers for the study of electrical distribution problems and fluid network analyzers for gas and water distribution systems.

The second type of analog computer is the operational analog. This type of computer consists of a collection of individual building blocks. Each of these performs some basic operation on the voltage with which it is connected. Electronic building blocks are used to perform such operations as addition, subtraction, integration with respect to time, multiplication, division and others. Networks of these operational units can be assembled to represent equations for the state of physical systems.

Answers obtained from analog computers are in the form of curves or graphs. Often these curves are produced by plotting devices such as strip chart recorders. In other cases the curves are displayed on oscilloscopes and recorded photographically. Data in the form of curves can be used for input information. Special devices are used to automatically convert these curves into equivalent electrical voltages.

In general, all operations in an analog computer are simultaneous. It is necessary to use as many electronic building blocks in the study of a problem as there are operations to be performed. The number of building blocks available limits the complexity of the problems that can be handled by a single piece of equipment. Computing facilities containing up to 1000 building blocks have been assembled. The average installation, however, contains from 50 to 100 units.

Digital Computers: Large digital computers can more properly be called data reduction systems or data control centers. These perform many operations on large quantities of information at high rates of speed. Large pieces of equipment are required, but the operations carried out by such systems are quite elementary. Electronic components are coupled together to form a working system that performs the various functions in a logical fashion.

Modern digital computers consist of the following major components:

1. An input device for presenting the information and instructions to the automatic system in a usable form. Input units may be such devices as typewriters, punched paper tape readers, punched paper card readers or magnetic tape readers.
2. A memory system for the storage of information, intermediate results and instructions. This system may employ magnetic drums, tapes or cells; acoustic delay lines; electrostatic storage tubes and vacuum tube circuits.
3. An arithmetic unit for the computational operations.
4. An output device for transferring the information obtained through the computing device to the operator in a form suitable for his use. These devices are similar to those used for the input.
5. A control unit for the coordination of the operations of each of the above units.

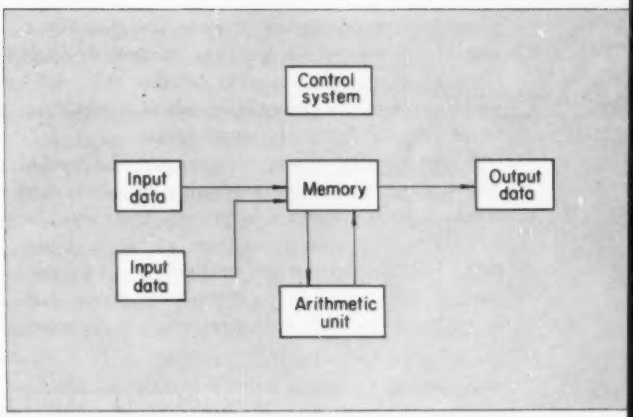


Fig. 5. Block diagram of digital computer system. Input data is fed into the "memory" circuit, which stores information, intermediate results, and instructions. Computational operations are carried out by the arithmetic unit. The output device transfers the results of computations to the operator. All operations are coordinated by the control unit.

Digital-Analog Devices: With the advent of large automatic computers, it became necessary to develop devices to prepare and present large volumes of data at speeds sufficient to assure economic utilization of the equipment. Most of these accessories are designed to minimize manual handling of information. Other devices convert data into forms more usable by the machine.

Information necessary to control manufacturing processes frequently occurs in analog form and consists of such continuous variables as position, velocity, temperature and others. The sensing and transmission of variables of this type to an analog



Fig. 4. Large digital data reduction center, designed to perform many operations upon large quantities of information at high rates of speed.

computer for processing involves the transformation of one type of analog data to another. Many types of accessories are used for this purpose. A potentiometer, for example, converts a shaft rotation into an electrical voltage variation.

Where a digital computer forms part of a control system or is used in the processing of information obtained from a continuous process, there must be a conversion at some point from analog to digital data. Suitable devices are available for this purpose, as well as for the conversion of digital data to analog form. The latter conversion is necessary



Fig. 6. Open-loop control system. The amplifier contains a device for carrying out the instructions furnished by the input signal. The output signal is the change dictated by the input signal.

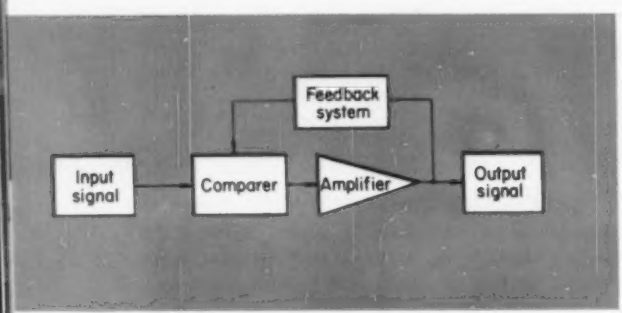


Fig. 7. Closed-loop control system. The input signal is compared with the output signal by means of a feedback circuit, and the output signal is adjusted accordingly

when a digital computing system is used to exercise control over a continuous process.

Other devices are used to transcribe information into forms more usable by machine operators. One such device receives numerical data through a keyboard and plots these data as points on a graph. Information from a graph or curve is printed in digital form by other devices. Equipment of this type assists in the reduction of data already recorded in one form or another and does not represent a link in the continuous flow of information within a system.

Digital versus Analog: Most modern control systems utilize continuous variables and employ analog type computing systems. Servo-controls exemplify this type of system and complex feedback networks are simplified analog computers.

As links become available for the inclusion of a digital computer as a portion of a control system, a question arises regarding the relative merits of digital and analog computers. Many factors influence the decision as to which type of machine performs best in a given application. These factors include such considerations as accuracy, flexibility, complexity and reliability, all of which must be evaluated in terms of ultimate cost. Each consideration depends upon the specific application and those that may be important under one set of conditions may be ignored for others.

Digital computers are generally considered to be more accurate than analog computers. The accuracy of a digital system is limited by the digit capacity, but this capacity may be readily increased by adding circuit elements. Some error is introduced in each basic operation in a digital computer where roundoff of results occurs and where there are a large number of such operations, roundoff errors may accumulate. The over-all accuracy of analog systems is limited, and may be of the order of plus or minus 0.1 percent of the full scale value of a given variable.

The fact that digital computers can be controlled by numerical input information may lead to a greater degree of flexibility. Another advantage of digital computers is that information storage and recall can be accomplished without complex circuit arrangements. However, many analog systems can be simply constructed and may cost far less than the barest minimum of digital computing equipment.

As the complexity of computer systems increases, reliability becomes an increasingly serious problem. Digital computers have many circuit components, and a low probability of error is required of each to assure proper operation over extended periods. Many errors produced by circuit failure in digital computers are difficult to detect and may have serious consequences.

Since failure of an individual component of an analog computer frequently results in complete failure of the machine, errors from component failures are readily detected. Drifts in the operating characteristics of an analog computer produce errors of rather small magnitude but these may affect the accuracy of the results.

Basic Control Systems: Two basic types of control systems are used: the open-end type and the closed-loop type. *Fig.* 6 illustrates an open-end system. The input signal is a demand for a given position or speed. The amplifier contains components for power amplification or control and a mechanism for performing the operation demanded by the input signal. The output signal is the change in position or speed called for by the input signal.

The accuracy of the change produced depends upon the calibration of the amplifier and the ex-

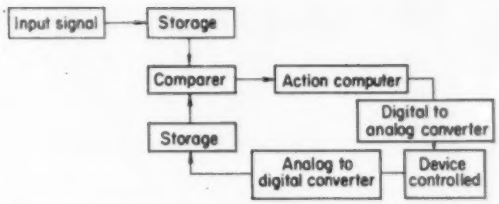


Fig. 8. Control system using digital computing elements. The action computer makes the decisions required to obtain the desired action of the device being controlled.

tent of amplifier drift. The load conditions on the device being controlled might also affect the amount of change produced for a given input signal.

Development of closed-loop control systems incorporating feedback circuits resulted in greatly improved accuracy. *Fig.* 7 illustrates this type of control. Both the input signal and a portion of the output signal are connected to a comparer circuit. The difference between these two signals is amplified and used as the output. The amplifier gain is sufficiently high to reduce the required input from the comparer to a value below the error limits imposed on the system. By this means the two inputs to the comparer are forced to be equal and the accuracy of the output signal becomes dependent on the feedback circuit rather than the amplifier.

Closed-loop systems are often used for accurate control of motor speed. An input voltage equivalent to the desired speed of the system is produced. A tachometer produces a second voltage which is equivalent to the actual speed of the motor being controlled. The difference between these two signals is amplified and used to control the voltage source for the motor. If output speed increases, the difference signal decreases and the voltage applied to the motor is reduced, thus keeping the output speed approximately constant.

Computing systems may form part of the amplifying unit. *Fig.* 8 shows one method by which a digital computer might be employed in control. In the system illustrated, a numerical input signal is placed in the upper storage unit. The output signal, converted to numerical form, is placed into a second storage unit. The comparer provides the computing circuit with the difference between these two numbers. The computer, through a process programmed in advance by the operator, determines the action to be produced in the controlled circuit. It is not necessary that the output be proportional to the difference signal at the input to the computer. There must be a means, however, of determining output action in some logical manner.

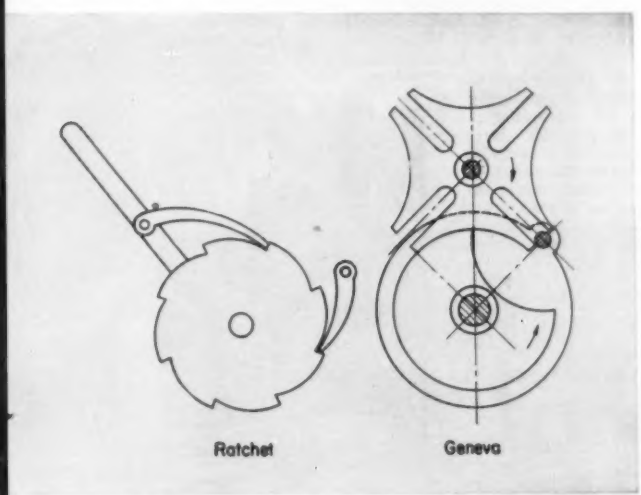


Fig. 9. Mechanisms for converting continuous rotary motion into intermittent rotary motion.

Discrete Variable Machine Tools: The majority of machine tools operate through continuous drive mechanisms and controls. The tool feed on a lathe, for example, moves continuously as the control crank is rotated. Digital control of these machines requires the utilization of analog-to-digital and digital-to-analog converters.

Digital control could be simplified through the development of machine tools that function in discrete steps. Intermittent motion of drive mechanisms and the sensing devices that provide feedback would be required. Two intermittent drive mechanisms are shown in *Fig.* 9. The ratchet mechanism operates from an oscillatory motion of the output shaft. The Geneva mechanism produces a quarter turn of the output shaft, shown on top, for each complete revolution of the input shaft.

This discussion serves only as a brief introduction to the broadening field of computing devices and machines. Special purpose computer-controlled machines are rapidly appearing on the market. A punched paper tape controlled milling machine is an example. Not all applications need involve elaborate computing systems or the control of large machines. A rather small analog type machinability calculator indicates what can be accomplished with a low-cost device.

Some of the devices provide assistance to the machine operator in carrying out his duties. Others convert ordinary machine-shop tools into flexible machines capable of turning out small lot jobs at prices that could become competitive with larger lot mass production jobs. Thus, the job shop can achieve some of the advantages enjoyed by the large production shops. One fact appears certain. Tremendous potentials exist in the field of automatic control, and only time and engineering effort are required to exploit them.

designed for

PRODUCTION

Integrated Press Line Maintains Flexibility

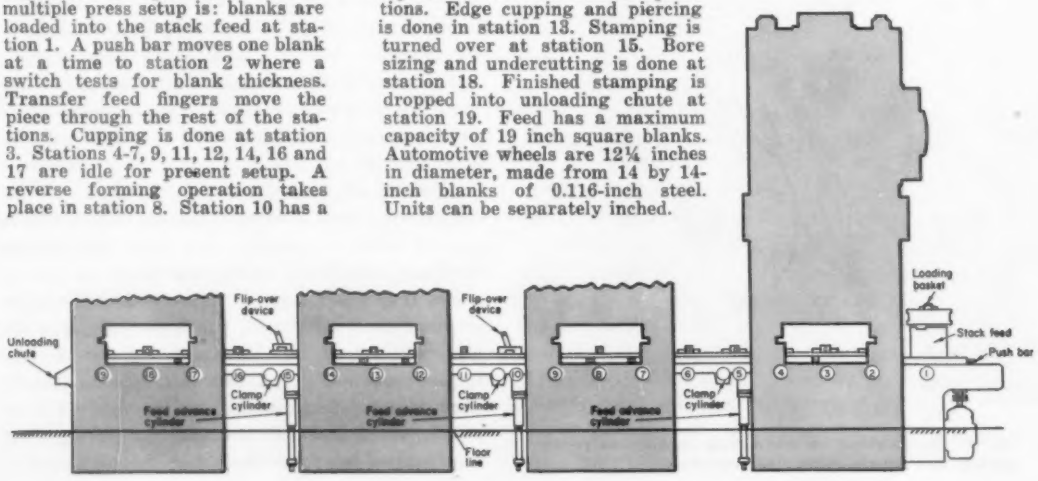


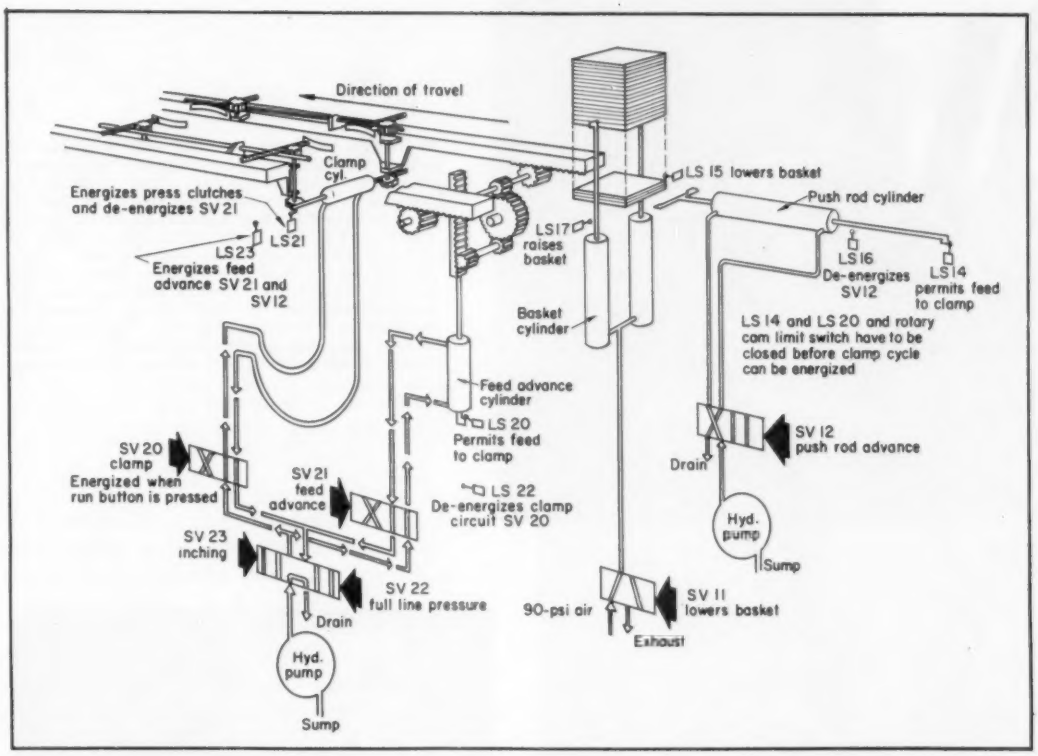
ONE 275-TON press and three 600-ton presses have been integrated with a feed system to increase production of automobile wheels. Last operation sizes the holes and undercuts the bosses.

To increase productivity without limiting future production or product design freedom, this four-press line has been developed for flexible operation. For production of automobile wheels by The Dunlop Rim & Wheel Co. (Coventry, England), four individual presses are used instead of a single, large transfer-feed press. Three of the presses are equipped with feeding mechanisms. These feeds are hydraulically and mechanically locked together to function as a single automatic unit. All equipment was developed by Clearing Machine Corp., Chicago.

Whenever desired, the line can be extended or reduced. The feed systems can be deactivated so each press can be operated independently. Feeds are designed so that the sections of feed bar immediately in front of the die area can be removed, leaving the entire area open for die changing. For the present setup, feed bars need not be removed when handling the dies.

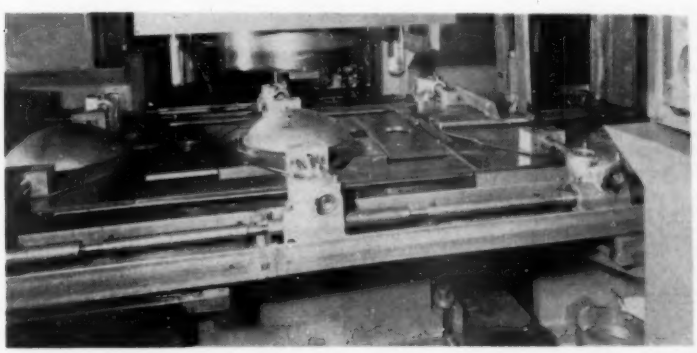
SEQUENCE of operations in this multiple press setup is: blanks are loaded into the stack feed at station 1. A push bar moves one blank at a time to station 2 where a switch tests for blank thickness. Transfer feed fingers move the piece through the rest of the stations. Cupping is done at station 3. Stations 4-7, 9, 11, 12, 14, 16 and 17 are idle for present setup. A reverse forming operation takes place in station 8. Station 10 has a flip-over device for future operations. Edge cupping and piercing is done in station 13. Stamping is turned over at station 15. Bore sizing and undercutting is done at station 18. Finished stamping is dropped into unloading chute at station 19. Feed has a maximum capacity of 19 inch square blanks. Automotive wheels are 12¼ inches in diameter, made from 14 by 14-inch blanks of 0.116-inch steel. Units can be separately inched.





BLANKS are fed into the transfer mechanism from the bottom of the stack. A push bar, operated by a hydraulic cylinder timed with the transfer feed, slides the bottom blank forward to a positive stop. Two blanks cannot be moved because there is vertical height for only one. The transfer feed consists of 17 sets of fingers that move inward from front and back to clamp parts and carry them from right to left 24 inches. Fingers then move out and return to home position. All transfer fingers act at same time. During most of travel through presses, pieces are slid along a runway that is flush with the lower die surfaces. Flat handling and short feed travel minimize problems of inertia.

A double-acting hydraulic cylinder mounted vertically on the side of each press operates a gear rack that drives a pair of feed channels left and right. A second double-acting hydraulic cylinder is suspended from the channels and operates a rack that is connected to a series of gearboxes mounted along both channels on 24-inch centers. The feed fingers are mounted on small racks protruding from these gearboxes and they are driven in or out by the stroke of the cylinder for "clamp" and "unclamp" motions.



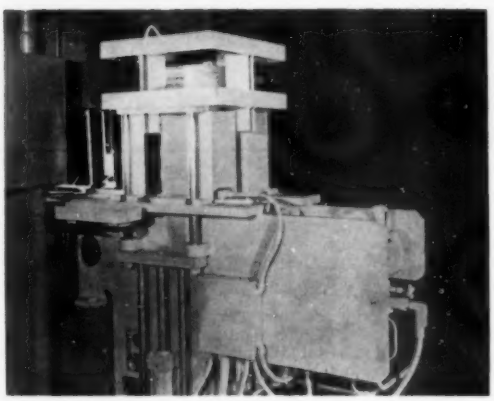
CUPPING die in station 3 of the first press requires full pressure obtainable from the press. In station 2 at right, position stop arm and double-blank limit can be seen. Three 600-ton presses are used at 500, 300 and 300 tons so there is plenty of capacity for future operations of this line.

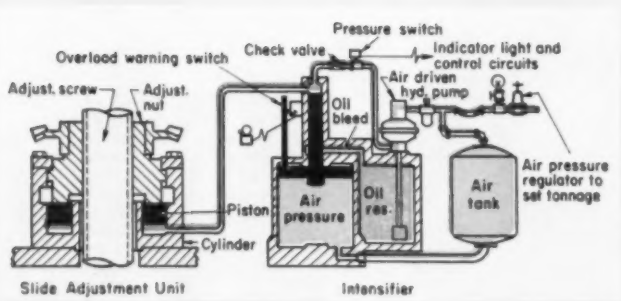
DESIGNED FOR PRODUCTION



FLIP-OVER mechanisms are simply pairs of heavy fingers that are spring loaded to stand vertically. At station 15, these fingers are tripped to a horizontal position, lying flat on the runways. In this horizontal position, the fingers grip the piece part, then advance toward station 16. Halfway between these stations there is a gap in the runway which permits the springs to rotate the fingers to the vertical position. As the fingers continue to advance past the gap, they are tripped another 90 deg, completing a 180-deg turnover. On the return stroke, the fingers reverse the process.

STACK FEED with loaded basket of blanks in position on top of stack. This design permits reloading without interrupting automatic operation. Each steel basket holds an 8-minute supply of blanks, about 100 pieces. Baskets are bottomless and the blanks rest on cams projecting from the sides. A full basket of blanks is placed in position on a pneumatically elevated platform directly above the feed stack. When the previous supply of blanks has been reduced to six pieces, a limit switch is tripped, which lowers the basket onto the stack. The basket cams are pushed aside and the contents of the basket are deposited on top of the stack.





OVERLOAD protection device comprises a hydraulic cushion that prevents the press from building up loads beyond its capacity during the last ½ inch of stroke. The unit is enclosed within the slide. Slide adjustment nut is seated on piston of a small hydraulic cylinder. Oil under the piston can go only to the intensifier. Slide load builds hydraulic pressure in the adjustment cylinder. When pressure is high, piston of intensifier goes down and adjustment unit compresses. If overload causes adjusting unit to compress as much as 0.10 inch, intensifier piston will bottom and oil will begin to bleed into reservoir. Further compression, as much as ½ inch, will continue to cause oil to bleed.

punching laminated plastics

By E. C. Graesser

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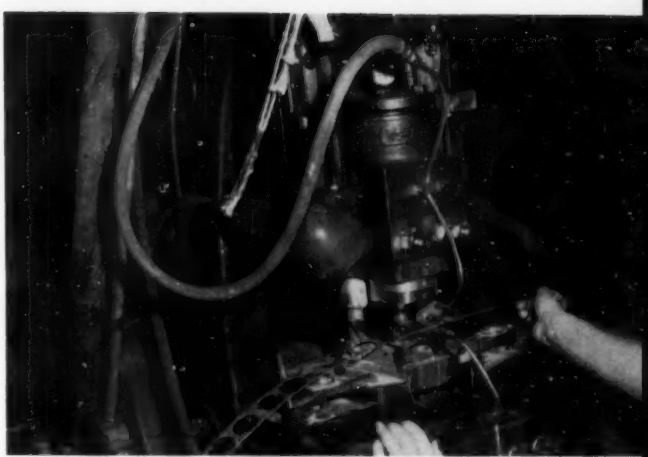


Fig. 1. Compound die, constructed of tool steel, in operation cold punching paper base laminated phenolic parts.

TO PRODUCE PRECISION PUNCHED parts from laminated plastics requires careful punch and die design to insure optimum production rates and required precision in the punching operation. Such parts are used extensively in the electrical and electronic industries, in printed circuitry, electric motors, electronic controls and numerous components for radio and television. In the manufacture of laminated punchings, standard power-driven presses are generally employed, *Fig.* 1.

In designing the tooling, it is necessary to know the properties of the material as well as thickness of the stock, size and proportions of the finished piece and quantities to be produced. In addition, it is necessary to know whether the grade used should be punched hot or cold and what dimensional tolerances are required in the stamping.

Material Properties: Laminated plastics are available in many different grades, each with a different set of electrical and mechanical properties. They generally comprise a fibrous filler impregnated with a thermosetting resin. Such fillers as paper, cotton fabric, nylon, asbestos or glass fabric are impregnated with phenolic melamine or silicone resins. Some punching grades of laminated plastics can be punched cold in thicknesses up to 3/32 inch. Harder grades require heating in thicknesses from 1/32 inch up. The tool and die designer, therefore, must know the grade of material to be punched, so that he can design the die accordingly.

Sizes and Proportions: Factors of size and proportion of the piece being manufactured influences the basic punch and die design. In good punching practice, the edges of the piece should not be closer to the edge of the strip than twice the thickness of the sheet. The hole should not be smaller in diameter than the thickness of the sheet and the distance between holes (or between holes and the edge of the piece) should not be less than the thickness of the sheet.

Quantity of Run: Construction of the die depends upon the quantity of parts being produced. For example, an inexpensive, thin die might well be designed for a "one shot" run of 5,000 parts, whereas a heavier die would logically be designed for continuous production of large quantities of the same part. Cross section of the die must be sufficiently strong to insure economical die life.

Cold vs. Hot Punching: Since some grades of laminates can be satisfactorily punched cold, fields of application for these are increasing, particularly for copper-clad printed circuits. Automatic assembly

Table 1—Approximate Dimensional Correction Factors
(For plastics with paper or cotton fabric bases)

Material Thickness (inch)	Blanking Die Size		Piercing Punch Size	
	Cold Punched (Inch)	Hot Punched (Inch)	Cold Punched (Inch)	Hot Punched (Inch)
1/32	— 0.002	— 0.0000	0.0020	0.003
1/16	— 0.004	— 0.0015	0.0040	0.007
3/32	— 0.004	— 0.0015	0.0065	0.010
1/8	— 0.004	— 0.0015	0.0090	0.012
3/16	— 0.004	— 0.0015	0.0150	0.016

of printed circuit components requires close registration of punched mounting holes for proper insertion. More precise dimensions of holes and hole spacing are obtainable when punched at room temperature. Until recently, certain electrical grades of laminated plastic could only be hot punched, but heating of the laminate made it difficult to hold dimensional tolerances. Expansion of a heated sheet along its length may differ from that across its width and varies with the material involved. A cold-punching laminate, such as Grade XXXP-470 Phenolite, is a practical solution to this problem.

In certain cases, electrical or mechanical requirements necessitate the use of hot-punching laminates. The degree of heat used for punching depends entirely upon the thickness and grade of the material. Often, 200 F is enough but in some cases, up to 275 F is required. Heat can be applied to either the material or the dies. Methods of heating include steam platens, electric platens, infrared lamps or ovens. When the desired temperature is reached, the material should be punched immediately.

Punch and Die Dimensions: All laminated plastics expand when heated. When punching is done at elevated temperatures, the blanks shrink as they cool to room temperature. This would seem to indicate that the blank would be smaller than the die. This is not true because all laminates yield when punched.

Yielding causes the blank to increase in size by an amount greater than the amount of shrinkage during cooling. Thus, the blanking die for hot punching should be smaller by the amount shown in Table 1. In hot punching, for dimensions over one inch in length or diameter, effects of thermal expansion must be compensated for in the calculation of distances, center to center between punched holes, and also the over-all length. In such cases, a factor of approximately 0.002 inch per inch of length should be allowed (based on punching at approximately 225 F). In the case of cold punching, the only effect is that of yielding. The die size is even smaller than that for hot punching because there is no thermal contraction.

Similarly, due to the effects of shrinkage and yielding, the piercing punch must be sized larger as indicated in Table 1. Varying with thickness in stock and method of punching (hot or cold), blanking dies are smaller and piercing punches are larger. The values given in Table 1 are sufficiently accurate to produce parts with tolerances of ±0.003 inch for paper and cotton fabric base grades of plastics. To obtain best results, clearances between punches and dies should be kept to a minimum (0.001 inch maximum) and the die kept sharp.

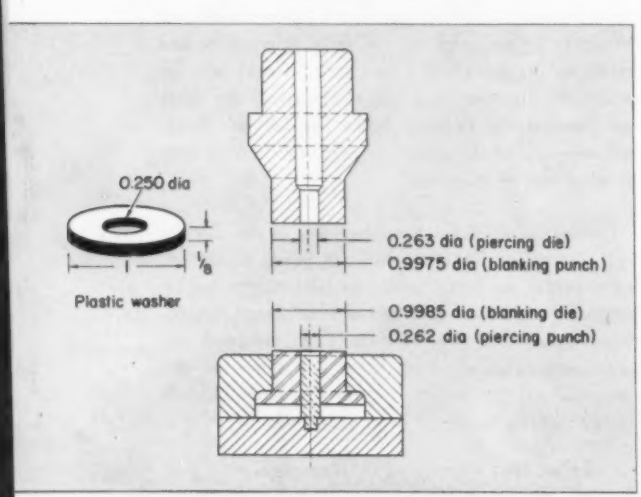


Fig. 2. Diagram showing tool and die dimensions calculated to punch a 1.000-inch diameter washer with 0.250-inch hole.

Dimensional Correction Factors: To indicate the usefulness of Table 1, blanking die and piercing punch sizes will be determined for a 1.000-inch OD washer with a 0.250-inch hole. The material thickness is 1/8 inch and hot punching will be employed. Details of the design are indicated in the sketch, *Fig* 2.

(a) Blanking Die and Punch Diameters

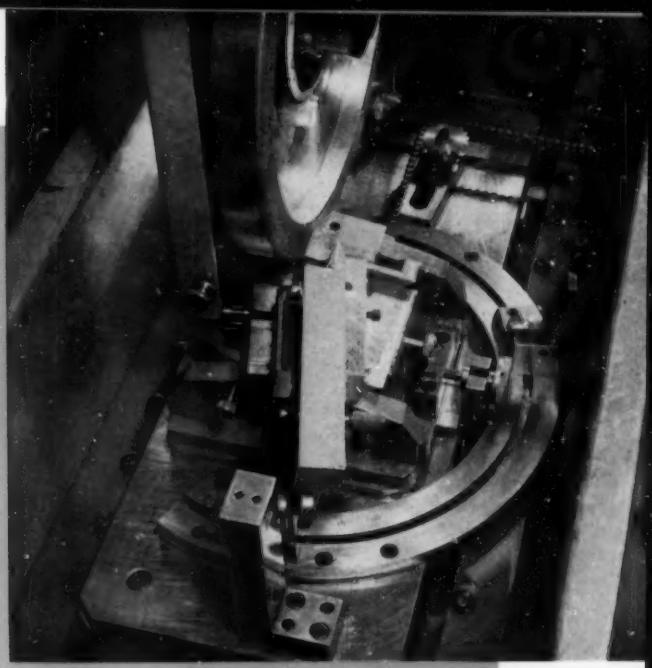
1.000 diam
— 0.0015 (factor from Table 1)
0.9985 diam (blanking die)
— 0.0010 (maximum die clearance)
0.9975 diam (blanking punch)

(b) Piercing Die and Punch Diameters

0.250 ID
+ 0.012 (factor from Table 1)
0.262 diam (piercing punch)
+ 0.001 (maximum die clearance)
0.263 diam (piercing die)

Sufficient experience has been gained to prove beyond a doubt that plastics provide certain advantages when used properly. Either hot or cold punching operations for laminated plastics produce precision parts if all basic factors are considered.

electrical discharge grinding *of tools*



Prototype arrangement for grinding single-point tools. By presetting controls, side clearance angle, front clearance angle and nose radius can be ground automatically.

By V. E. Matulaitis

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ALTHOUGH ELECTRICAL discharge machining will be applied in many phases of metalworking, its use in tool grinding is representative of the current state of the process. This process is now the object of claims and counterclaims, fanatical enthusiasm and firm rejection. Advantages and disadvantages of electrical discharge grinding, as applied to the processing of tools, will be summarized in terms of known facts.

Although the remarks that follow apply generally to cutting tools made of any material, attention is specifically directed to consideration of carbide tools, both single-point and insert types.

Heat Checking: Many problems that arise in the use of carbide cutting tools have their origin in the heat checking produced by conventional grinding. Close examination of carbide tools that have been ground with diamond wheels shows that the edges of the tools are honeycombed with incipient heat checks. Such fractures range in depth from 0.0001 to 0.003 inch and occur with a frequency of 50 to 100 per inch around the perimeter of the tool. Because they are so small, the presence of the cracks can only be demonstrated after careful etching.

Heat checking can be reduced by preparing tools under laboratory conditions but such careful treatment cannot be afforded for everyday cutting tools. Tools processed in the laboratory can frequently outperform identical tools prepared under normal production procedures. Heat checks originate because of the high localized pressures that exist at the instant a grinding wheel leaves or enters a cutting edge.

Although the term "electrical discharge machining" or its equivalent, "arc machining," frequently creates a mental picture of gross melting and mass fusion, surface finishes in the order of 10 microinches, rms, are readily possible with electrical discharge machining. Even "rough" electrical discharge machining is gentle to the workpiece. For example, a two inch wide by one inch thick block of carbide can be double plunge cut in the two-inch

Abstracted from paper 24T6, "Electrical Discharge Grinding of Tools," presented at the 24th ASTE Annual Meeting. Copies of the complete paper are available for purchase from Society headquarters.





Standard grinder (above) converted to an electrical discharge machine.

Single-point carbide tools (right) finished by electrical discharge grinding. Tool at left has been finished all over, tool at right has been ground only on form.

face to a depth of ¾ or ⅞ inch with a ½ inch wide wheel to leave a web of 0.005 to 0.007 inch between the two cuts. Creation of such a thin web between cuts has little practical application, but the fact that it can be produced by electrical discharge machining is significant. This is positive proof that such metal removal techniques are gentle.

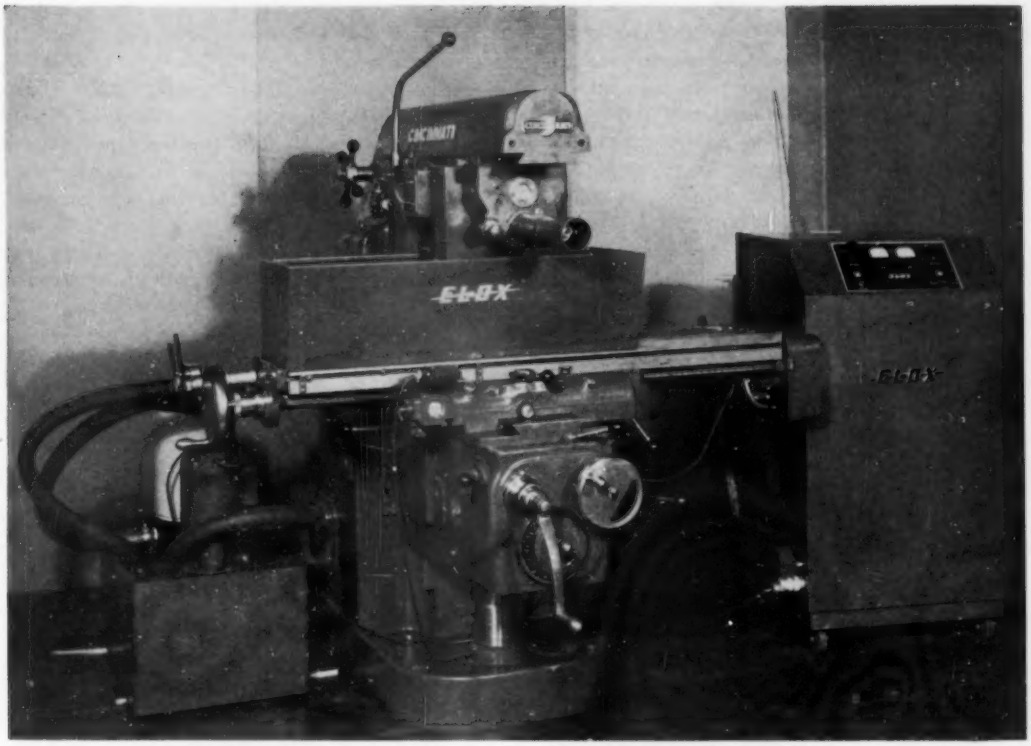
Metal Removal Rate: The rate of metal removal with electrical discharge machining is exact, predictable and repetitive. It is represented by a simple coefficient that is easily established for any particular power supply. With electrical discharge grinding, the rate of metal removal depends only on the type and power capabilities of the power supply used. Typical power supplies have metal removal rates of 0.0025, 0.005 and 0.008 cubic inch per minute.

The maximum feasible rate of metal removal is determined by the ability of the workpiece to pass electrical current. For extremely small cross sections, the permissible rate of metal removal is substantially lower than the figures listed previously. For large sections, 3 by 3 inches or larger, rates of metal removal with large abrasive wheels may substantially exceed those possible with electrical discharge grinding because of the limitations of currently available power supplies.

Since there is no danger of damaging the workpiece with electrical discharge grinding and since the machining process is automatic and not under the control of an operator, metal removal rates can be as high on delicate as on rough grinding operations.

Grinding Costs: Consideration of cost is complex to the extent that three factors should be evaluated simultaneously to effect a completely worthwhile analysis. These factors are: capital cost of original equipment, cost of expendable materials used during the machining operation and cost of labor.

Electrical discharge power supplies are complex and, for the present, necessitate a substantial initial capital equipment investment. Desirability of such



Horizontal milling machine converted for discharge grinding. It has rigid spindle and can be used for heavy cuts in wide-faced brass wheels.

an investment depends entirely on the usefulness of the equipment. If as many as 100 tools are to be ground each day, investment in electrical discharge grinding equipment can be economically justified.

Removal of one cubic inch of carbide with electrical discharge grinding involves the expenditure of approximately 3 cubic inches of brass. This is about one pound of brass and represents a cost of less than $3.

Although abrasive grinding and electrical discharge grinding may involve substantially equal periods of time to perform a given operation, labor is involved only in setup with the latter method. An operator may need to spend only 10 minutes of each hour at the machine and considerable labor expense can be saved if the operator can be assigned additional work.

Tool Life: Probably the most important single factor to be considered when evaluating any physical method for sharpening tools is that of usefulness or life of the sharpened tool. Rapid processing and low costs are unimportant if the finished tool is not satisfactory. It has been found that electrical discharge methods are entirely satisfactory.

In general, tool productivity improves from 30 to 50 percent in the case of tools used for the heaviest, roughest types of machining involving interrupted cutting. Productivity increases rapidly as machining severity diminishes until about 700 or 800 percent improvement is attained at light finishing cuts of the magnitude common in broaching operations. It is of considerable interest that increased tool life is noted with severe cutting conditions.

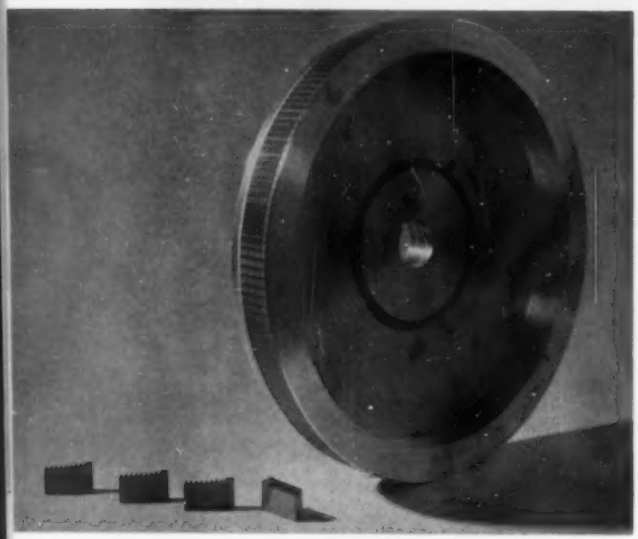
Surface Finish: Since heat checking is relatively absent in tools processed with electrical discharge grinding, surface appearance of the sharpened tool is not too important. What appears to be a substantially rough surface on a tool can be used to achieve any prescribed machined surface finish.

Wheel Wear: Glazing of the brass wheel used in electrical discharge grinding is impossible. If the grinding wheel is designed to sharpen or process a specific number of tools, regardless of how many, the last tool will be ground with the same quality and in the same manner as the first. Dressing of the grinding wheel is unnecessary.

The brass wheels normally used in electrical discharge grinding show considerable wear. This high wear factor can be made unimportant. In conventional cup-wheel grinding of single-point or insert carbide tools, for example, wear of the brass wheel

is readily compensated by simple adjustment of the cross slide of the grinder. Since such adjustment might prove to be a nuisance, electronic wear-compensating devices can be added to the basic grinder. Such compensating kits can constantly maintain the operating surface of the grinding wheel within 30 to 40 millionths of an inch of an exact fixed position. With automatic compensation, the effect is that of a grinding wheel which exhibits no wear.

Carbide thread chasers and the formed brass wheel used to grind them.



If form tools are to be processed, wheel wear can be compensated for by dressing or skiving the brass wheel with a suitable form tool between the rough and finish grinding operations. The ease and convenience with which a brass wheel may be machined or shaped far outweighs the inconvenience of dressing the wheel. The low cost of brass means that wheels may be machined repeatedly to any desired form.

Holding Pressure: The complete absence of physical contact between the grinding wheel and workpiece in electrical discharge machining greatly simplifies the problem of holding or clamping the workpiece. For processing composite steel-carbide parts or tools, permanent magnets embedded in the worktable frequently provide more than adequate holding pressure.

Automatic Operation: Since discharge grinding is an electrical process, suitable voltages or signals are conveniently available for actuating conventional servomechanisms. This permits the construction of substantially automatic machines that can perform for long periods without operator attention.

When To Automate?

Crucial problems faced by management in considering when to automate and how much were dramatized in a lively presentation at the Society of Automotive Engineers' 1956 annual meeting in Detroit. The mythical company was identified as manufacturer of Heliotracs, hybrid between helicopter, tractor and automobile. The cast was comprised of executives from the automotive industry with A. T. Colwell, vice president of Thompson Products in the roll of executive vice president of the imaginary Heliotrac Co.

As the play opened, an executive conference was considering the bad news that the Heliotrac had slipped badly in market position. It appeared that obsolescence of the product's design and management's resistance to investment in modern machine tools had brought about a serious drop in sales.

Heliotrac sales manager C. L. Hecker (Oliver Corp.), manufacturing manager L. I. Woolson (president DeSoto), chief engineer E. N. Cole (chief engineer Chevrolet) and purchasing agent F. E. Farrell (assistant director of automotive sales for Bendix Aviation Corp.) each disclaimed responsibility for the debacle.

Spirited interchanges enlivened proceedings over such topics as whether to make or buy parts, volume of production required for economical automation, design requirements for automation and to what extent automation should be employed. Problems of interim production until installation of automation equipment and production of the advanced design agreed upon also produced lively discussion among the participants.

The chief operating executive, Arch Colwell, finally secured agreement from the Heliotrac executives of the extent to which automation would be economical. The findings are summarized as:

1. Automation demands greater coordination between engineering and manufacturing as well as understanding by management.
2. Design programs must be planned years ahead and be integrated with automation equipment because of the heavy capital investment involved.
3. Automation is no cure-all for all problems and needs to be specifically tailored to each individual situation.

The program agreed on as a result of these principles imparted a sense of direction to the management team. The Heliotrac Co. appeared headed for a sounder future at the curtain.

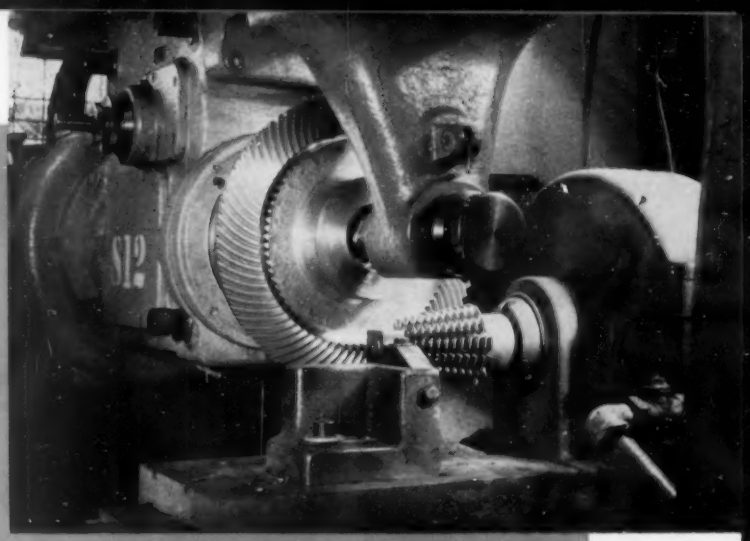


Fig. 1. Spiroid gear being hobbed. This new tooth form has many interesting advantages for instrument gearing.

the challenge of instrument gears

By Louis D. Martin*
Gear Consultant
Rochester, N. Y.

INSTRUMENT GEARS, defined as gears of twenty diametral pitch and finer, embrace 13 different tooth form systems, 19 different types of gears and 180 different pitches. It is theoretically possible to reproduce 10 of these tooth forms for each of the types and pitches of gears. Thus, it is possible to make 34,200 gears of different tooth forms having different pitches but the same number of teeth.

Tooth form systems vary widely, *Fig.* 1. Many are peculiar to an industry like the watch industry. Other branches of the instrument field also have adopted their own special and preferred tooth forms. And still other segments just happened and grew by hit or miss methods.

In 1942, the American Gear Manufacturers Association, recognizing the utter lack of standards which could serve as guides for this expanding field, created the Fine-Pitch Gearing Committee. The achievements of this committee and the monumental job it did is a matter of record. Today we have standards to guide the instrument gear field that have withstood the test of time.

Instrument gears are made of many materials ranging from tool steels to paper-base phenolics. The material choice must necessarily be broad because of the diversified service requirements. The manufacturing processes are also diversified. They might be listed as follows:

1. Milling
2. Hobbing
3. Gear shaping
4. Stamping
5. Cold-drawing wire
6. Die casting
7. Cold extruding
8. Sintering metals
9. Injection molding
10. Grinding
11. Shaving
12. Lapping

Costwise, instrument gears vary from a fraction of a cent, for die-cast pinions used in speedometers, to four hundred dollars or more for a single gear used in armament projects.

Gear Making Equipment: Equipment for making instrument gears has not been developed in this country to the same extent that it has in

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Abstracted from paper 24T23, "An Objective Look at the Field of Instrument Gearing," presented at the 24th ASTE Annual Meeting. Copies of the complete paper are available for purchase from Society headquarters.

foreign countries. Gear cutting equipment is closely wedded to the automotive and other comparable high-production industries where large expenditures for labor saving equipment are quickly absorbed by returned profits.

Foreign manufacturers have taken the lead especially in the area of grinding equipment in ultrafine spacing checking equipment. In this field, there are no American-made theodolites worthy of comparisons to those made in Europe. Probably the reason is that economic necessity forces foreign manufacturers of gear cutting equipment to diversify. All of their machines have greater versatility than ours which are generally geared to mass production and integration in automation setups.

There are a number of worthwhile machines that the instrument field could use to advantage. This equipment would be priceless in an all-out defense effort. The sad part of it is that when the time of stress comes, the manufacturers will be too busy on other things.

Gear Materials: The advancements made in the production of instrument gears by methods other than cutting processes follows closely the struggle for more suitable gear cutting equipment. High-density powder metals have been developed with tensile strengths of 125,000 psi and higher. One of the advantages of this type of fabrication is that gears and pinions can be combined in a single component. It is also possible to eliminate operations by combining cams, couplings and similar parts with the gear teeth and to include keyways or splines in the bore of the gear.

A variety of different materials is currently being sintered, including brass, bronze, iron and stainless. In the appliance field, powder metallurgy is effecting some dramatic savings. The art of producing molds for the coining process has advanced greatly in the last five years. Most sintered gears fall in the category of good commercial to low-precision types, as defined by American Standards for fine-pitch gears.

About ten years ago injection-molded nylon gears began to appear in a number of appliances. The early attempts at fabricating by this method were far from successful because the molding companies knew little about the art of gearing and had not yet learned how to compensate for mold shrinkage. Now, injection-molded nylon gears are being used in a large variety of appliances such as electric timers, clocks, meters, food mixers, speedometers and motion picture equipment. As with sintered-metal gears, large savings are possible by combining gears with other components and by making gears and pinions integral with each other.

Inherent in the molding process are factors which require the use of multiple-cavity molds for best economy. The quantity required must, of course, justify the mold cost. Single-cavity molds for small parts are used to produce prototypes and are generally combined with other molds for short runs. So-called family molds, where several dissimilar parts are combined together, are not practical for regular production.

One of the chief factors of success in the production of injection-molded nylon gears is painstaking

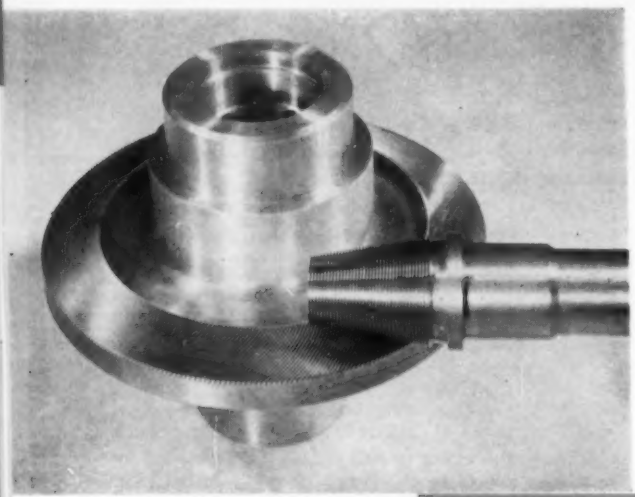


Fig. 2. Spiroid gearing forms a high-ratio right-angle drive and can be produced on standard hobbing machines.

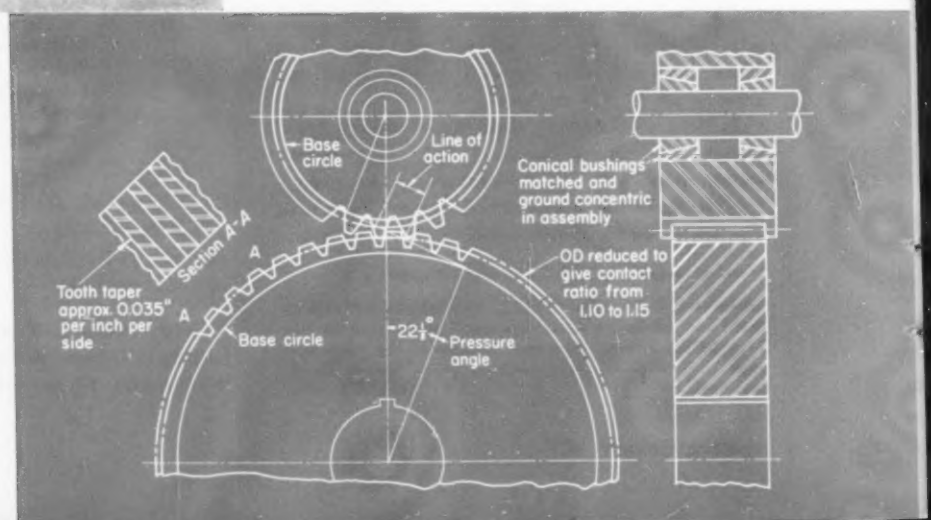


Fig. 3. Tapered-tooth gear designed to prevent backlash and have long life.

attention to the design and manufacture of the mold cavities. Other factors are a comprehensive knowledge of the behavior of nylon and a fund of empirical data to draw from in determining mold shrinkage. Quality-wise, nylon gears range from a commercial two class to a commercial four class as defined by American Standards for fine-pitch gears.

Probably no other process or material has offered more opportunities in recent years for savings and improvement in product than injection molding and nylon FM-10001.

Gear Standards: Instrument gears are not necessarily small gears as many think. The determining factor is diametral pitch, or number of teeth per inch of diameter. Instruments vary widely both in size and function. Of the several tooth form systems developed for the instrument field, American Standard 20-degree Involute Fine-Pitch System, B6.7-1950 has best met the needs of the majority of instrument gears used in consumer goods.

It should be realized that standards are not irrevocable mandates imposed on industry merely for the purpose of establishing uniformity. Standards should be considered only as guides and as the practices established by the general consent of users, makers and designers of a product. Good standards which endure and become popular in usage allow for a freedom of choice and for minor departures from their basic principles.

In the field of gearing, the best design for a given application cannot always be obtained by following a single set of rules. This is especially true in the field of instrument gearing which is highly diversified. In this field, it is frequently necessary to depart from accepted practices to some extent or other without necessarily abandoning the general principles of standard tooth-form systems.

Each gear application must be studied as an individual problem for best results. Standards should be followed as much as possible but one should not hesitate to depart from the beaten path to meet requirements. In the field of instrument gearing, there is no single common denominator that will make it possible to solve all problems in the same manner. Standards are established and developed to meet the requirements of the average, or greatest number of cases. They must be changed from time to time to keep pace with new ideas.

Many minds work on a problem. Some have the solution within their grasp but miss it by a hair's breadth. Another, reviewing the work that has been done by his predecessors, approaches the problem from a different angle and finds a solution. The difference between success and failure of the first investigators might have been the overlooking of a small practical detail. Perhaps a segment of the problem depended on something that had not yet been invented. The following examples will serve as illustrations of this type of problem.

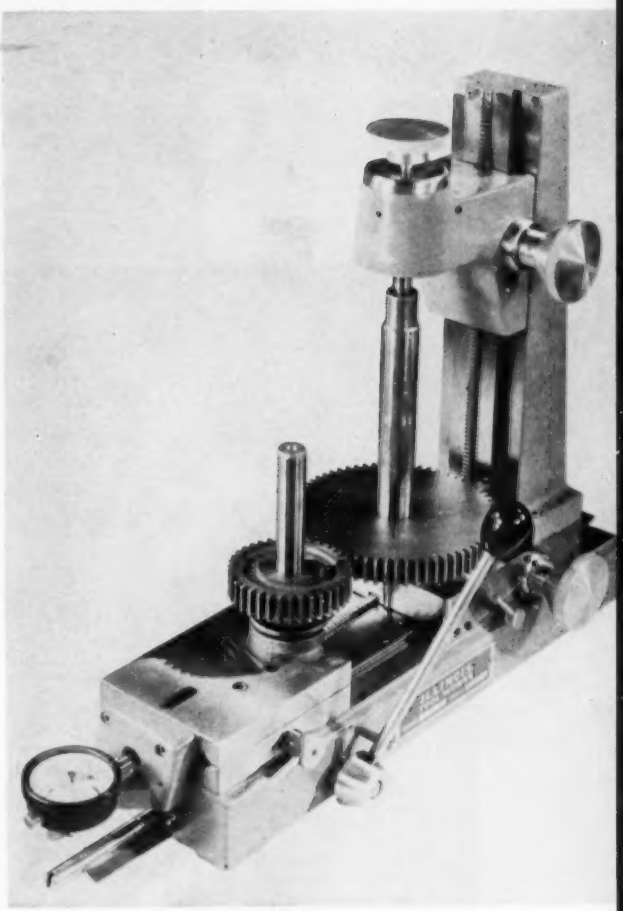


Fig. 4. Simple variable-center-distance gage controls the pressure between master and work.

Spiroid gears, *Fig.* 2, introduced recently by the Illinois Tool Co., look like hypoid gears commonly used in automobiles. They are a recent addition to high-ratio right-angle drives. The pinion, which is in the form of a conical thread, may have one or more threads.

There are a number of interesting things about spiroid gears. One is that they have desirable properties for certain types of instruments. Another is that they can be produced readily on any standard hobbing machine as shown in *Fig.* 1.

Another unorthodox solution to an instrument gear problem may be of interest. It emphasizes the fact that it is often necessary to go off the beaten path for a solution to a problem.

In an instrument drive, a gear train was required to reverse the direction of a slide driven by a leadscrew. Backlash requirements at the leadscrew were extremely close. The service requirements were severe, with high loads and long life expectancy.

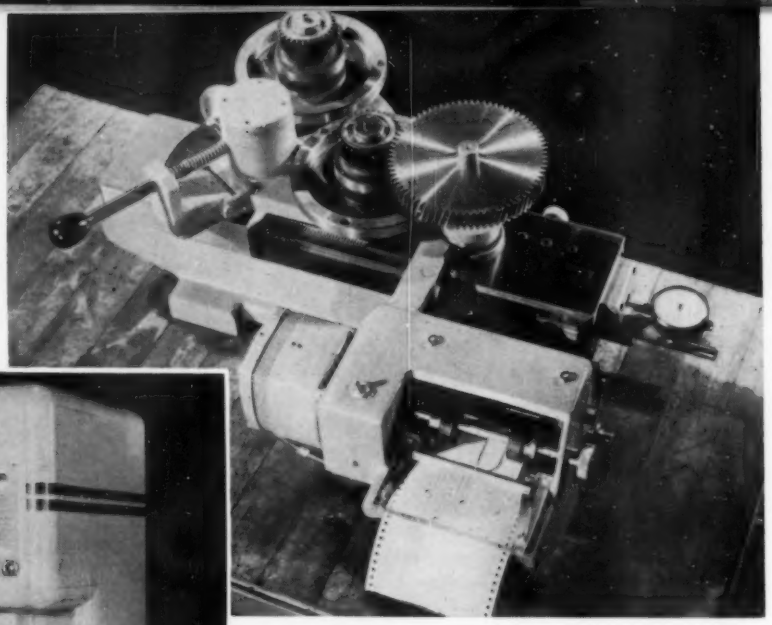
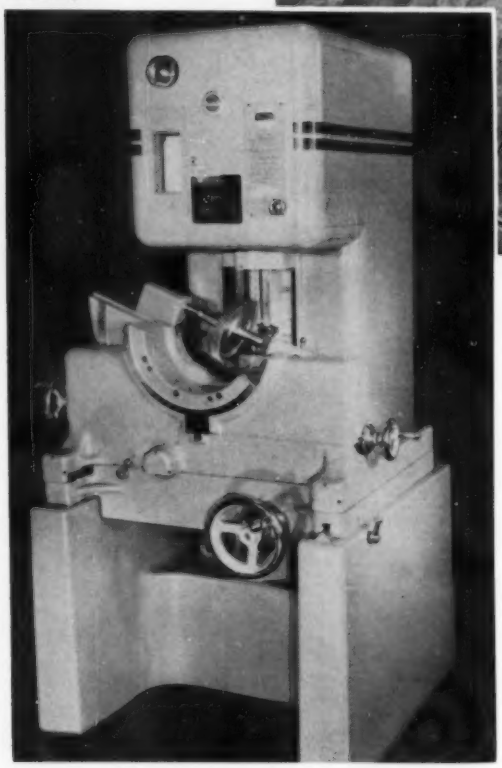


Fig. 5. Recording type variable - center - distance gage.

Fig. 6. Conjugate gear checker, using master-worm section as checking element, has high accuracy.



Fortunately, space restrictions were not critical and cost of the device warranted the best type of gearing possible. The main objectives were to have no measurable backlash as well as low inertia loads and good surface durability of the gear teeth.

In order to prevent backlash, it was decided to use gears with tapered teeth. The tooth taper decided upon was 0.035 inch per inch, per side, as shown in *Fig.* 3. This amount of taper is more than sufficient to take care of all of the variables.

Since the elimination of all lost motion requires also the control of eccentricity in the bearings as well as control of gear and bearing centers, it was decided to use Class 7 ball bearings. All gears are carburized alloy steel and the teeth were ground to master-gear specifications.

Conical expanding bushings were marked and ground in pairs so that the outer surface of one member would be concentric with the inner member.

In order to obtain high beam strength and a low scoring factor, a 22½-deg pressure angle was used. The contact ratio was held from 1.10 to 1.15. Also, in order to obtain the best condition of profile sliding and to get action as far away from the base circle of the pinion as possible, the gear teeth were stubbed while those of the pinion were not.

Gear Checking: One company has spent considerable money in an effort to learn how to make and check extremely accurate gears. It has developed a technique for checking the angular transmission error of motion-drive gears involving the use of theodolites and interferometry. The errors can be repeatedly verified on the order of two or three seconds of arc in 360 deg. Also, the company has an optical zeroing device with a sensitivity of 0.0000002 inch.

The gears being checked are cut on a custom-built Gould and Eberhardt hobbing machine mounted on a 25-ton block of reinforced concrete. The hobs are also custom-made and cost approximately $1200 each.

In order to reach quality objectives, many contributing factors had to be evaluated and each guarded against in its order of importance. All hobs are designed with the same number of gashes which correspond to the notches in the precision index plate of the hob sharpening machine.

It takes just as much know-how to engineer a gear train for an inexpensive item as it does to engineer a ship propulsion gear. Sometimes it is more of a challenge, and considerably harder to whittle off that last fraction of a cent from a cheap stamped gear train than to determine the dynamic loads of a gear rotating at supersonic speeds. The approach is different, but the basic engineering principles are not. The best gear for any application is the cheapest gear that will meet all of the

functional requirements and that can be produced in the quickest possible time.

Gear quality is relative; it depends on what criterion is used for evaluation. The revised American Standard, Inspection of Fine Pitch Gears recognizes the fact that there may be more than one yardstick of quality required to meet the needs of industry. The composite check is the basis of quality in this standard because it meets the requirements of the vast majority of fine pitch gears. It leaves the door open, however, for other methods of checking.

Nowadays, few parts are checked 100 percent. Inspection frequency is based on statistical studies that take into account the laws of random distribution of errors. The cost of inspection should be compatible to the cost of the finished product. Except in rare cases, where safety of personnel is a factor, it should be based on three things: First, the cost of the part; second, the replacement cost of that part in the mechanism; third, the selling cost of the item. This philosophy is particularly applicable to instrument gearing.

Historically, the composite or functional check, as it has been called recently, antedates all other methods of checking gears. Long before gear checking pins and comparators were invented, gears were checked by rolling one with another and "feeling" the tooth action. Later cam gages were developed with fixed centers and, still later, with variable centers. The advancement of the functional check was interrelated with the perfection of master gears of suitable quality and the incorporation of certain desirable features in the variable-center-distance gages. Another relatively simple functional checking fixture is illustrated in *Fig.* 4. This fixture, like many others of recent vintage, is equipped with pressure control between master and work.

The last decade has seen many advances in functional checking techniques. Fixtures of variable-center distance, used to check gears, have appeared on the market. It seems strange that while checking pressures had been established for such things as gage blocks and measuring wires, the influence of pressure on the checking of gears had not been given due consideration until recently. American Standard B6.11-1951 was the first attempt at giving guides for suitable checking pressures of gear teeth. Today, all modern checking gages have this feature.

Another variable-center-distance fixture equipped with a recording device, *Fig.* 5, graphically charts the radial displacement and provides a permanent record of the check. Discussion of variable-center-distance fixtures would be incomplete without mentioning the Conjugage. It is one of the latest of functional gear checkers, *Fig.* 6, and employs a master-worm section as a checking element. The master is ground as a thread on a drum, on which many sections are ground. Because of its method of manufacture it lends itself to great accuracy. The gage itself is equipped with an electronic recorder for charting radial displacement in any one of four different magnifications.

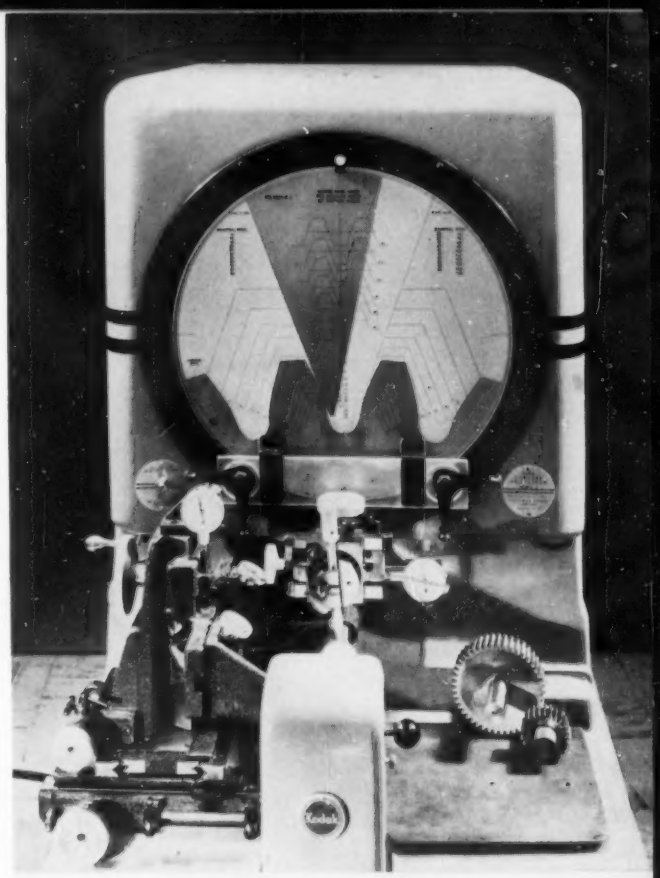


Fig. 7. Spur gear analyzer optically checks gear action.

Within the last five years, a new device for analyzing the errors of spur gears has appeared on the market. This device, *Fig.* 7, called a spur gear analyzer, is used in connection with a Kodak comparator and is a contribution of the Optical Gaging Products Co. The principle of this device is analogous to the motion of a basic rack and gear in mesh and operating without slippage.

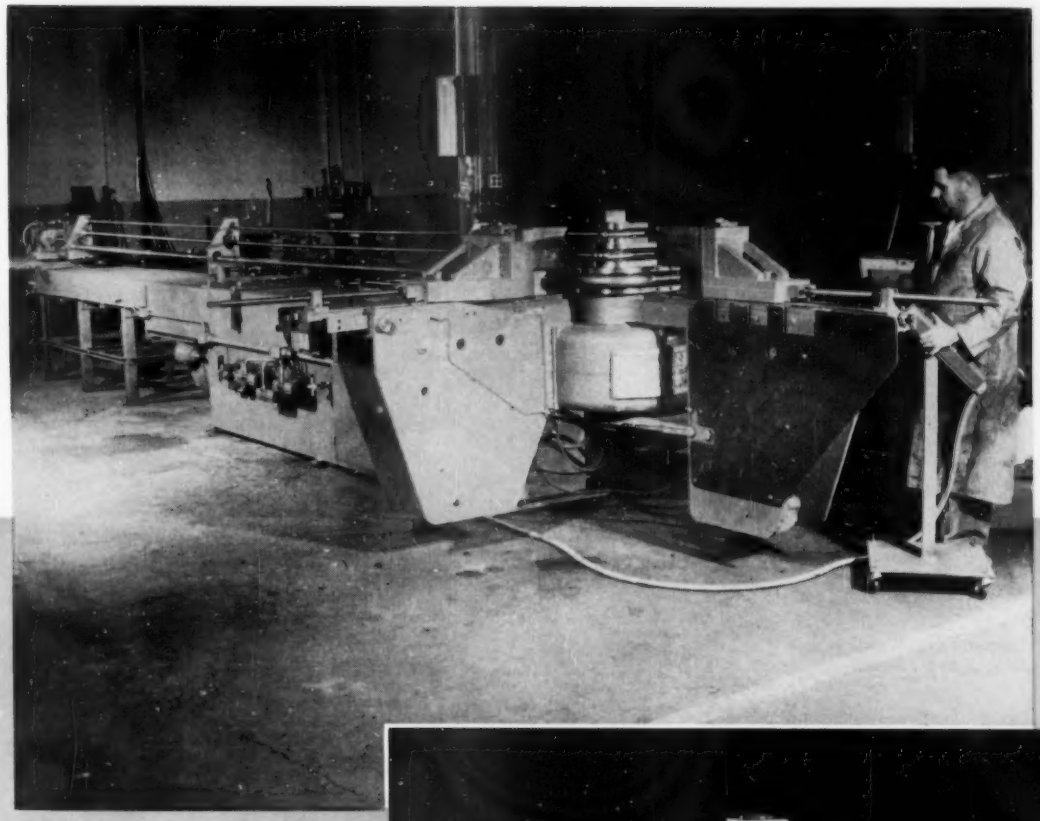
The correct conjugate action, along the line of action, can be determined and deviations reduced to changes in pressure angle. Tooth-thickness variations from a nominal size can also be determined as well as circular-pitch errors. In its present embodiment, this particular checker is suited only to spur gears. This gear analyzer has filled a gap in the instrument gear field and is giving a good account of itself.

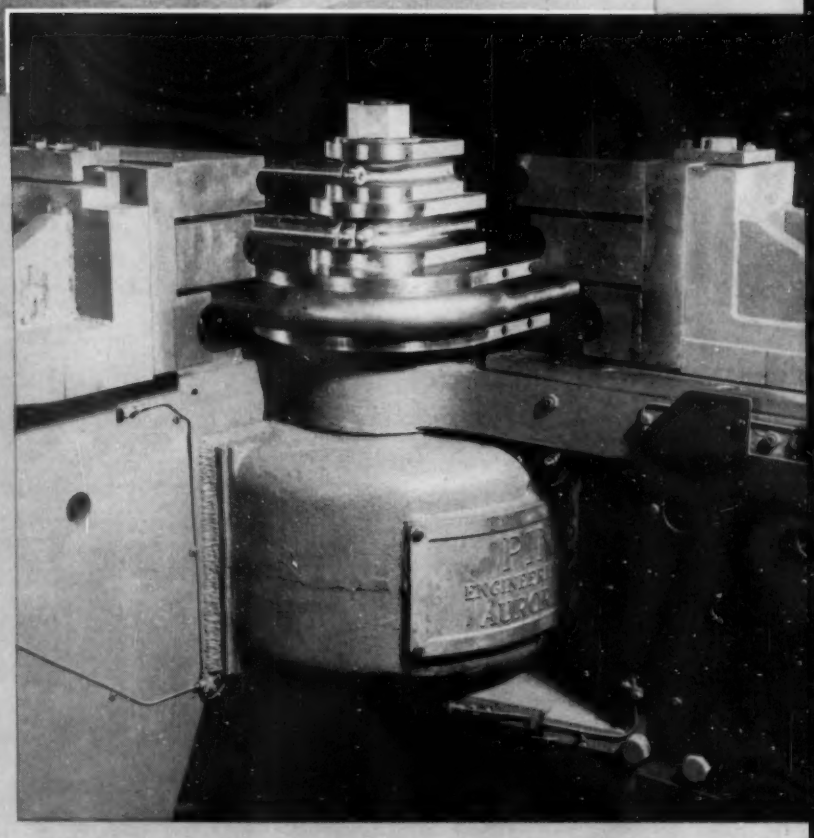
The field of instrument gearing is tremendous and is broadening. There will be many challenges. The opportunities this fascinating field has to offer are limitless.



AUTOMATIC INSPECTION of precision electromagnetic relays has eliminated a critical production bottleneck in the electronic industry. Equipment is a hi-pot tester designed and used by Potter & Brumfield Mfg. Co., subsidiary of American Machine & Foundry. The tester scans as many as 90 separate circuits in a single relay in less than a minute, making practicable 100 percent factory inspection of such parts.

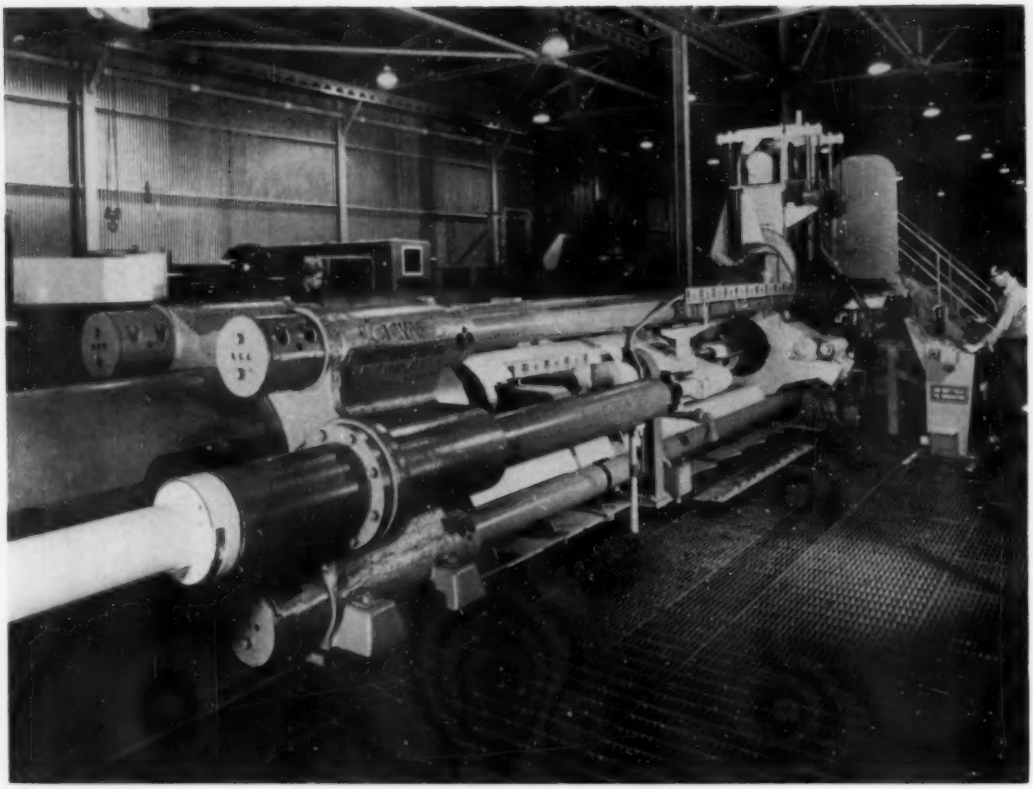
TOOLS at work





PRODUCTION IS INCREASED and set-up time saved by good tool design of dies for this automatic bending operation. Dies for the three most common sizes of tubing are stacked so that any or all of them can be used at one time. Bending cycle of the machine is automatic. When the operator has positioned the tube, he pushes a button to start the continuous cycle. The clamps close on the tube. The arm rotates through the desired angle to make the bend. The ball mandrel is pulled from the bent section and the clamps then open. After the tube is removed the operator pushes the return button; the arm returns to starting position and the mandrel advances to bending position again.

—Photos courtesy Pines Engineering Co., Inc.





HEATED BILLET ROLLS through powdered glass, left, which serves as lubricant in extrusion press. Induction heating unit in right background brings billets from room temperature to 2300 F in about a minute. Billet in the 1000-ton horizontal extrusion press above at new Jones & Laughlin Steel Corp. extrusion plant in Pittsburgh is squeezed into complex section. Material is low carbon steel.

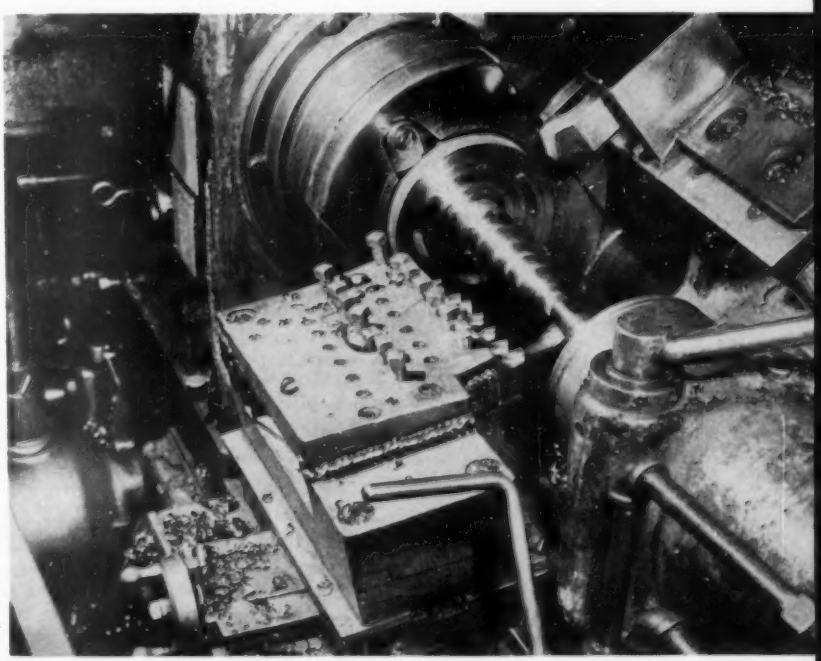
TOOLS at work



SPECIAL PORTABLE pneumatic hand-router developed by Glenn L. Martin Co. tool engineers is used to trim heavy wing skin. Cutting tool is a half-inch milling cutter. An adjustable guide is clamped to the routing head and held against the trim-template as the operation progresses. The tool permits rapid trimming, produces edges equal to machine finish, is accurate and minimizes hand filing of parts.



OPTICAL ALIGNMENT of heavy machine tools is exemplified by F. H. McGraw & Co. team setting up Pratt & Whitney die-cutting machine in Alcoa Cleveland plant. Equipment is to be used to produce dies for giant forging presses and vertical, and horizontal alignment of 0.001 inch is required. Engineer is sighting through microalignment telescope to adjust machine alignment.



MULTIPLE TOOL setup employs eight brazed type flat tools and an insert holder for turning alloy stem gears on an automatic lathe. This setup resulted in a jump in production from 30 to 50 pieces per hour. In addition, tool costs dropped because of longer tool life and lessened breakage. The job is now run at 305 sfpm with average cut of $\frac{3}{16}$ inch.

—Photo courtesy Wesson Co.

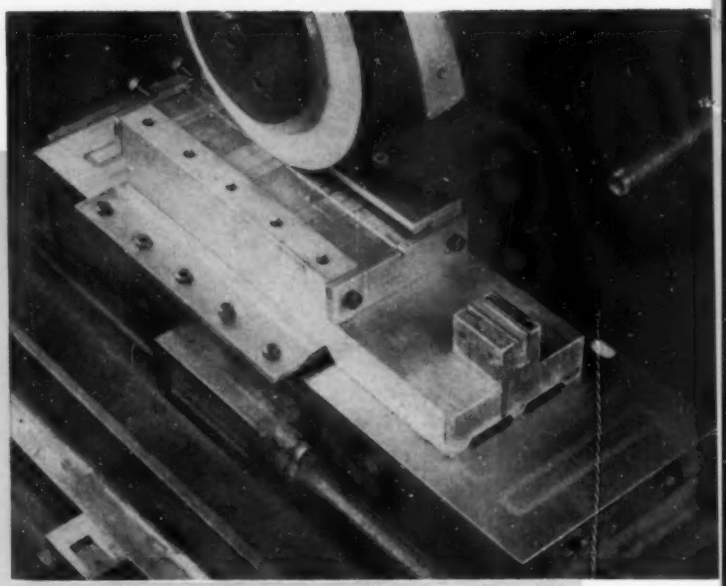


Fig. 1. CDP diamond block mounted on surface grinder. Used to dress grinding wheel to cut V-notches in a specimen for impact testing.

—Photo courtesy Metals Research Lab., Carnegie Institute of Technology

dressing grinding wheels

with cemented diamond particles

By C. L. McCabe†
Carnegie Institute of Technology
Pittsburgh, Pa.

WITH THE INTRODUCTION of powder metal techniques for setting diamond particles in tools, new uses have become feasible. Such diamond-impregnated tools have extensive uses as abrasive media and costs for their production are not excessive. Cemented diamond particles, CDP, range in size from about 62 to 710 microns. Particles of this type are in adequate supply and their price is stable.

Diamond particles can be formed into shaped tools, *Fig.* 1, by embedding them in a suitable powder metal matrix. One class of CDP tools, dressers for grinding wheels, will be discussed. Such tools can be used to dress either organic or vitrified-bond grinding wheels.

One of the most important considerations in the dressing of grinding wheels with small diamond particles is the size of the diamond particles relative to the wheel grit, wheel hardness and depth of dress cut, *Fig.* 2. If the diamond particles are too large in relation to the wheel grit, the wheel will squeal and glaze and the dressing action will be poor. If the diamond particles are too small, they will be undercut and fall out. In general, the average diameter of the diamonds is a factor of two or more larger than the size of the wheel grit and the depth of cut should be the minimum which will give a free-cutting wheel. If the depth of dressing cut is too large, the diamonds will be dislodged and if the dressing cut is too small, the wheel will not be put into a "sharp" condition and its face will not be cleaned. The proper combination of these three factors is only determined by experience with the machine, the material to be ground, the wheel, the specifications of the finish and physical dimensions of the work.

There is little published information on what happens when a diamond dresses a grinding wheel. The individual grit particles in the wheel are either fractured or pulled out. It seems reasonable that,

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Abstracted from paper 24T27, "Cemented Diamond Particle Tools and Wheels and Their Application to the Dressing of Grinding Wheels," presented at the 24th ASTE Annual Meeting. Copies of the complete paper are available for purchase from Society headquarters.

under dressing conditions where the diamond point is sharp and the depth of dressing cut not too great, the individual grit particles of the wheel are fractured and thus sharpened. If a single-point diamond is replaced by a CDP tool, the grinding wheel is usually given freer cutting action and will produce more pieces per dress with the same dressing cut. With CDP tools, there are many diamond points so that dressing traverse speed can be high.

Since there are many layers of diamond points which can be used before the tool is worn out, CDP tools have long life. Long tool life means less down time. Also, CDP tools are often used in a single position throughout their productive lives.

In the actual production of the cemented diamond particle material, there are several conditions which must be met. Diamond particles must be of the same quality as those used for single-point tools. Inferior grades decrease tool life and are not economical. Particles must be uniformly distributed throughout the metal matrix. Poor distribution makes the dressing characteristics of the tool vary with time and causes a loss of grinding form. Particles must be chunky rather than elongated.

The metal matrix must be capable of holding the diamond particles securely without attacking them during the manufacturing process. The metal matrix material must be soft enough so that it can be abraded, allowing the diamonds to protrude slightly from the surface of the tool, but should be hard enough to maintain its shape.

Dressing Flat Surfaces: The most prevalent use of CDP tools is in the field of thread grinding, *Fig.* 3. Reason for their adoption is their demonstrated ability to dress the grinding wheel in such a fashion that sharp roots can be consistently obtained. A possible explanation of this is that the CDP dressing action results in fracturing of the individual wheel grit particle. It is also feasible to dress a sharp root flat using the CDP tool. Long wheel life results since light dressing cuts, less than 0.0005 inch give a free-cutting wheel.

Tools with a flat dressing surface are used to dress wheels for the production of parts with good surface finishes. Since the individual grain of the grinding wheel is fractured, good surface finish is achieved on a wide variety of internal and external grinding operations with few dressings per shift. In one case, it is reported that dressings per shift were reduced by 600 percent when using a CDP tool instead of a conventional single-point diamond. Sharpness of the fractured grain insures good cutting characteristics for the wheel, and the relative flatness of the grain results in good surface finish.

Dressing Formed Surfaces: The possibility of using a shaped CDP tool to dress a form in a grinding wheel has merit where a contour dresser is undesirable. Large diamonds lapped to the form are sometimes used for this purpose but manufacturing and diamond costs are high. To do this operation more economically, a CDP tool, *Fig.* 4, has replaced a lapped single-diamond tool of the same form. In the manufacture of the CDP tool,

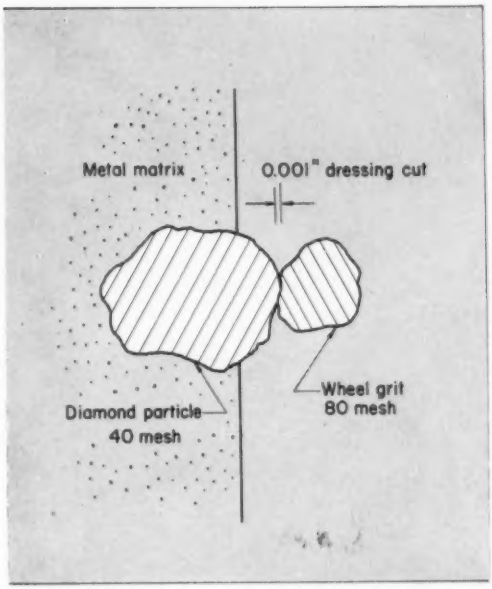


Fig. 2. Schematic diagram showing relative sizes of diamond dressing particle and wheel grit.

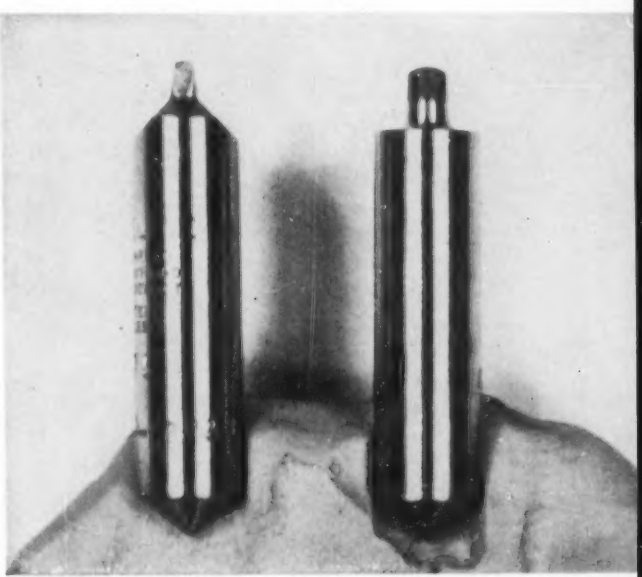


Fig. 3. CDP tools for thread grinders. Tool on left is for Ex-Cell-O 3-way dresser and tool on right is for Ex-Cell-O universal cam type dresser. Diamond particle coating is approximately ¼ inch long.

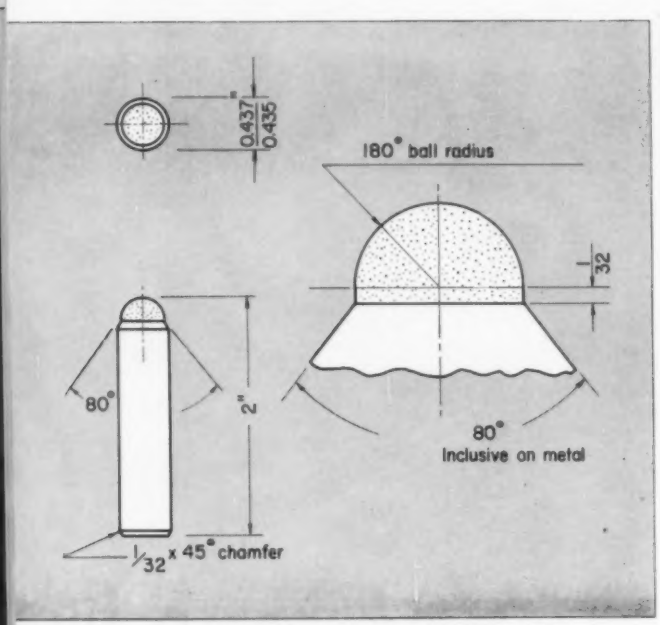


Fig. 4. Drawing of a shaped CDP tool for dressing a form in a grinding wheel.

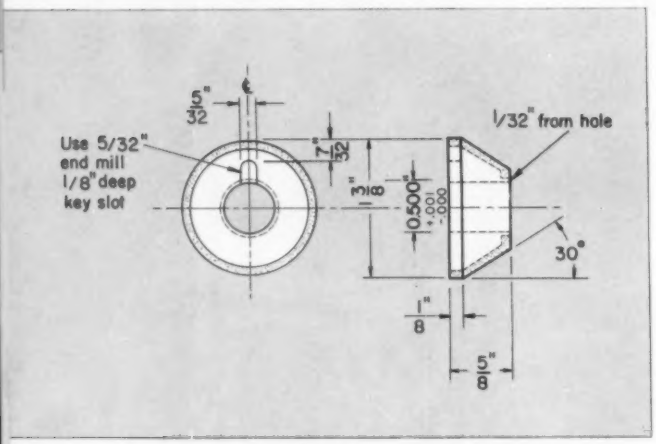


Fig. 5. CDP wheel for dressing sides of a grinding wheel for use on Jones and Lamson form grinder.

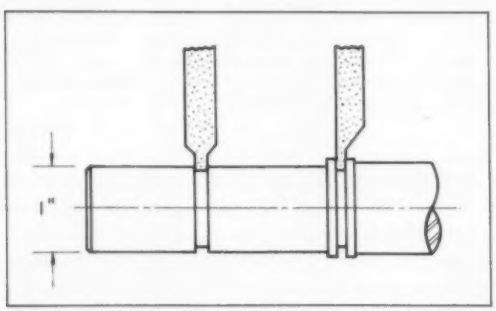


Fig. 6. Grinding wheels, formed by the CDP wheel shown in *Fig.* 5, are used for grooving.

the head containing the diamonds takes the shape of the formed mold in which it is made. Bruting and lapping normally associated with shaping a large diamond is unnecessary or of minor importance in preparing CDP tools.

CDP Wheels: In devising grinding machines for automatic operation, it is desirable to have the diamond dressing device maintain its shape during long periods of use. One way to do this is to use many diamond dressing points rather than one or a few. Thus, the wear on the diamond is distributed over many points and the dressing device will maintain shape for a long time. One simple way to do this is to use a CDP diamond wheel. The CDP diamond wheel should be separately driven, *Figs.* 5 and 6.

CDP Blocks: An interesting application of the CDP material has been in the shaping of a grinding wheel on a surface grinder with the use of a CDP block, which has the shape of the form to be ground. An application using this principle is in the grinding of V-notches in hard-steel specimens for Charpy impact testing, *Fig.* 1. In the sequence of operations, the CDP block is placed in the holder in such a position that the notch containing the diamond particles is exactly aligned with the place where the notch is to be ground in the specimens. The worktable is passed back and forth and dressing of the wheel is automatically accomplished with each pass. The setup insures that the finished notch will have the same contour as the dressing tool. In this operation the depth of cut is 0.0005 inch and a generous supply of coolant is used. Over 500 specimens have been notched and held within the standard limits set on the V-notch without any noticeable wear on the diamond block.

Summary: It is felt that sufficient progress has been made in the use of CDP tools and wheels for the dressing of grinding wheels to warrant additional research and development. Wheels dressed by CDP and by single-point tools should be carefully examined. Design and action of dressing devices should be reinvestigated with the thought of taking full advantage of multiple diamond point dressing. The development of CDP tools has and will find use in a great many applications, but they will not replace many of the standard diamond tools in use today. However, it is felt that CDP products will result in expanded use of diamond dressing in grinding and in replacement by grinding of some machining operations.

Acknowledgment: The author wishes to acknowledge the help of Charles J. Koebel, Harry Kartcher and Robert Shelton for their many contributions to the content of this paper.

plant efficiency increased

by mechanizing materials handling

By Arthur Colton
Assistant Editor

Representative of facilities visited in the ASTE tour program is the refrigerator plant of Hotpoint Inc. in Chicago. This installation provides an outstanding example of the function of manufacturing engineering in developing a new approach to increase production with the use of advanced methods of transfer and more automatic operations.

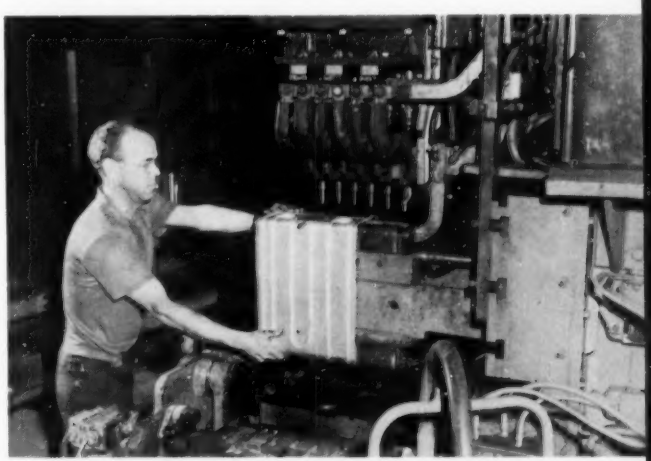
MATERIAL HANDLING plays an important role in industrial economy. Efficiency of mass production depends on the system selected for transfer of parts. Increases in production invariably follow improvements in methods of handling the parts involved.

Growing competition in the appliance industry has added impetus to research and development being carried on at the Hotpoint refrigerator plant at Cicero, Illinois, toward optimum efficiency in handling. Continuous advances require extensive planning and detailed study to devise and build a system that will function economically, consistently and accurately.

Tool Engineers' Responsibilities

More and more responsibility is placed on the shoulders of the tool engineer in program planning. He must visualize complete operation sequences and the processes required in such sequences. To reduce manufacturing costs, the materials handling system must be increasingly mechanized with greater emphasis on higher production and more automatic operations. Both present and future plans are developed with an outlook of meeting the keen competition in this field.

New equipment must be selected, analyzed and



Tangent bender incorporating resistance welder used in forming evaporator. Belt conveyor on left carries components to next work station.

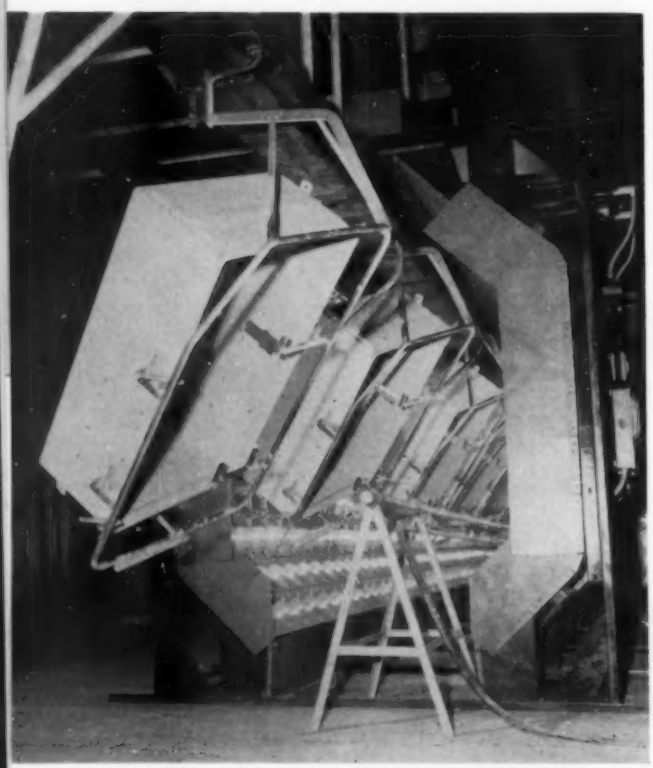
effectively utilized. Everything is done to reduce the physical handling of material within the plant. Removing the factor of fatigue also makes it easier for employees to do an efficient job with less effort.

Basic Requirements

An efficient production plan consists of the procurement of raw materials and supplies, scheduling of materials to appropriate points in the processing plant, actual processing, scheduling to assembly lines, and storing or shipping the end product. Unless production is planned with care, stocks will accumulate in unwieldy quantities at certain points in the plant while other divisions may be delayed by shortages of perhaps small but important items.

Flow control, where it is applicable, can be a major factor in increasing production. Processing must be progressive and continuous—progressive in the sense that the work advances from stage to stage and continuous in the sense that it is never interrupted in its straight-line flow.

A good transfer system is one element necessary for the efficient movement of parts through numerous work stations and a variety of operations. A conveyor system in a plant may be sufficient for present-day needs but increased production quotas could make it inadequate.



Liners arranged on specially designed hangers passing through line of infrared lights used for drying.

The Hotpoint refrigerator plant occupies approximately 1,000,000 sq ft of floor space. Throughout the entire area, 9.8 miles of conveyors move, carrying parts and subassemblies through to final assembly. Four types of conveyors are used: namely, chain, belt, roller and slab. In one section of the building over 27,000 ft of conveyors cover one acre of ceiling space. Conveyors travel at various levels from floor level up to a height of three stories in as many as seven different levels. Where overhead systems are used, component parts are suspended from overhead monorail tracks on steel arm carriers which move them through operations at a height convenient for the assemblers. There are 114 motors, ranging in size from 1 to 7½ hp, providing the power that enables Hotpoint to produce a refrigerator every twenty seconds.

Layout Requirements

There are two sections of the plant and each is housed in a separate building. One is for the fabrication of refrigerator shells, doors and food compartments, the other for the manufacture of component parts, final assembly, inspection and packaging.

The fabricating plant is laid out north to south with four separate production lines, one for cabinets, one for doors, one for food compartments and one for miscellaneous small parts. This allows the company to make each major part in an inline process. The flow of material on each section or line is carried on floor-mounted roller conveyors. Each line is complete in that all operations, shearing, forming, welding and inspecting are completed without being removed from the general line of flow of the conveyors. When one section of a production line breaks down, the flow of material can be rerouted through standby machines by portable motor-driven conveyors without changing production scheduling. Each roll conveyor line is approximately 190 ft long and progresses through 8 work stations.

After fabrication, the liners are passed through an automatic spray pickling process, placed on an overhead chain conveyor and passed through vitreous enameling and infrared drying. The liners are then removed from the firing chain and placed on a transport conveyor. They are carried to a height of 75 ft and transported to final asnembly in the main plant across the street. The transport conveyor from enameling to the final assembly area is 2378 ft in length.

A storage conveyor provided for finished liners is used for scheduling purposes. The conveyor has a drop in the vitreous enamel department at the

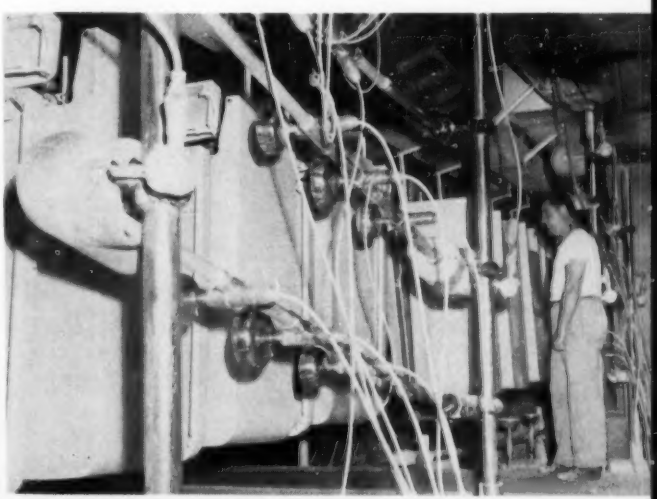
same location where the liners are placed on the transport conveyor. Another drop is located in the assembly plant. This operation permits the enamel department to operate on an odd shift basis without extra handling. If final assembly is down, the liners can be placed directly on the storage conveyor.

Hangers used on the liner transport and storage conveyor are designed to take both liners and pans. In transporting either item, one does not interfere in any way with the other. Actually, two separate conveyor systems are thus merged into one.

Refrigerator doors and cabinets are passed through a six-stage washing process consisting of an alkali wash, hot water rinse, cold water rinse, phosphating, cold water rinse, chromic-acid rinse and then into a drying oven. This is followed by transporting the parts through primer coating and infrared drying. The conveyor, which carries both doors and cabinets simultaneously, is now inverted by means of a specially designed conveyor screw. While in this position, the parts are automatically transferred to a grouping conveyor. A space of 4 inches is allotted between door and cabinet to allow freedom for painting of all surfaces.

Of design interest here is the fact that component parts of a single refrigerator are placed together on each carrier so that painting application will match. Painting is accomplished with an electrostatic process. While on the grouping conveyor, the parts are grounded. The paint particles are charged with 90,000 to 100,000 volts of electricity and sprayed from bell-shaped spinners that rotate at a speed of about 900 rpm. The particles, being charged, are attracted to the grounded doors and cabinets. Small parts such as hinges that would be blown off this grouping conveyor, are processed in adjoining spray booths.

Designed into the conveyor system at various points are washers that clean each carrier after the part being transported is removed or transferred to another line. These washers are an important part in keeping the conveyor system from clogging



(right) Grouping conveyor transporting cabinets and doors through electrostatic painting process.

(below) Refrigerating unit being submerged in water test tank. Conveyor dips down into tank, top right, proceeds through viewing station and raises unit to pass through automatic dryer.



and surfaces building up after passing through numerous painting or other chemical operations.

After enameling, the parts are transferred from the grouping conveyors back onto the transport conveyor for movement to final assembly. At this point, a subconveyor is integrated into the main line to carry the parts into a section of the main plant where insulation is installed. This subassembly line increases the speed of flow of materials while reducing over-all time of assembly by removing this secondary operation from the final assembly area. While the cabinets are being insulated, the doors move up for the addition of such component parts as hinges, handle, etc., and then both units merge into the main assembly line.

Engineering Coordination

The main overhead conveyor for the assembly of condensers and evaporators is 7650 ft long and carries all component parts. With a capacity of 2868 units spaced 32 inches apart, it is possible to assemble 190 units per hour on this continuous chain type conveyor. The line moves directly into component part departments instead of bringing the parts out to the line. This plan was devised to minimize trucking or handling of parts in the assembly area.

Production supervisors and production control departments do not have to contact any other department in meeting main assembly line schedules. Each section is a separate department and each is responsible for its component part.

The conveyor plays an important role in the assembly of the mechanical parts or components of the refrigerator. Each unit is assembled, tested and then added to another subassembly until the complete unit merges into the final assembly area. With the movement of materials instead of personnel, production flow is greatly accelerated with engineering coordination and advanced technical research, down time in these operations is reduced to a minimum.

Progressing from the evaporator fabricating section where the evaporator is placed on specially designed carrier arms, the conveyor moves into the condenser and frame-mounting sections and into the section where the heat exchanger and other bits of tubing are added. Joints are then silver soldered, but before the last joint is soldered, dry air is forced through the entire system at a controlled pressure to test for restrictions.

When the last joint is soldered, the unit is again charged with high-pressure dry air. The conveyor then drops down and submerges the completed assembly in a filtered-water leak test tank for 90 seconds. The tank is approximately 12 ft long, 4 ft wide and 8 ft high. The two side walls are of glass to enable observation of air bubbles rising from a unit and denoting leaks. Viewing operators report leaking units to a station several yards down





Charging refrigerating unit with oil and freon. Carrier design insures accessibility combined with rigidity.

Condenser being mounted on bracket holding refrigerating unit.

the conveyor line where necessary corrections can be made without stopping production.

Subassemblies are important in this line as each section must fall into place as the carrier passes through each work station. Minor holdup here would break the constant flow. More and more time is being spent in analyzing operations and designing new methods and equipment to assure uninterrupted production.

Passing through the leak-detecting tank and the air-drying process, the unit is next transported to virtually the most critical process in the plant—dehydration. This removes all residual moisture that may be present. To accomplish this, the monorail rises to a balcony overlooking the assembly area. The unit remains on the conveyor as it passes through the dehydration process. Four units are attached to each evacuating cart as it passes through the dehydration oven. Vacuum carts travel underneath the oven on a separate roller type conveyor. Eighty-two vacuum carts are used in the system.

After dehydration, the unit, with sealed-in vacuum, continues on the same transport conveyor through a hood containing helium gas and into a section where two mass-spectrometers indicate leaks, if any, in a unit by the detection of the presence of helium gas. The next work stations charge the unit with oil and freon.

Moving to an automatic dip tank, the unit is painted, moved up for wiring harness attachments and subassembly parts and into the unit test room. Unit testing of 150 units an hour is accomplished without removing them from the carriers of the transport conveyor.

The final assembly line is a slab conveyor, 565 ft long and approximately 18 inches above floor level. Major and minor subassembly conveyors deliver component parts at various stages along the main assembly line. Smoothness of operation is denoted by the lack of congestion in this area.

Incorporated in the final assembly is another leak test to check the sealing of the door and cabinet, and a sound booth checking operational noises. With the okay of final inspection, the completed unit passes from the slab conveyor onto a roller conveyor, moves through packaging and into the warehouse for storage and future shipment.

Future Developments

The entire system of materials handling at Hotpoint is geared to increase mechanization as much as possible. Manufacturing engineers are constantly working on methods of improving the conveyor system. Mechanized handling means greater production with more automatic operations.

Of primary importance is the coordination between engineers and the various department heads in planning future improvements. An active program is now being carried out for evaluating manufacturing methods with respect to material handling with the goal of attaining more automatic operations in the future to enable the company to produce a better product at lower cost.

(below) Slab conveyor for door assembly. Operational height reduces fatigue.

(right) Final assembly slab conveyor. Subassembly components are being transported to the final assembly area, top right.





plastic cuts cost and time during jig former fabrication

By K. H. Boucher
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JIG FORMERS USED in the aircraft industry to hold component parts in position for accurate assembly, must be fabricated to closer tolerances than those of the assembly they will position. Normal practice in fabricating such formers is to use steel shapes, such as angles or bars, and bend or machine them to the desired contour. Great care must be taken to hold the precise tolerances necessary.

Considerable monetary and time savings are realized through the use of a blend of epoxy resin. This resin is nonsagging and can be applied to the gap between a roughly formed steel shape and a master plaster pattern, *Fig.* 1. Precise metal shaping is not required because gaps up to $\frac{3}{16}$ inch wide can be filled by the resin.

The resin is mixed in batches of one or two gallons, placed in polyethylene containers and quick frozen to –90 F in a bath of dry ice and alcohol. After ten minutes in the bath, chemical reaction is arrested and the container can be stored at –10 F until required. Working life of the mixture out of storage is approximately two hours.

Before the resin is applied, the plaster pattern is treated with a parting agent and the roughly formed metal guide is fastened in position. The disposable polyethylene container is placed in a gun and the resin expressed through the nozzle by regulated air pressure. The cavity between the steel form and the pattern is filled to overflowing and the surplus resin is scraped away, *Fig.* 2. After a six-hour cure at room temperature, the new former is removed from the master pattern and is ready for use.

Versatility of epoxy resin with regard to application, greatly decreases fabrication time of jig formers. Repeated precise machining operations, required when metal formers are used, are all but eliminated, resulting in substantial savings.

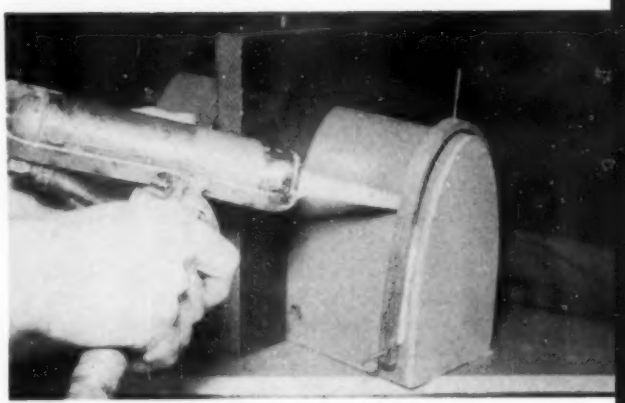


Fig. 1. Air pressure forces the resin between the roughly formed steel shape and a master plaster pattern.

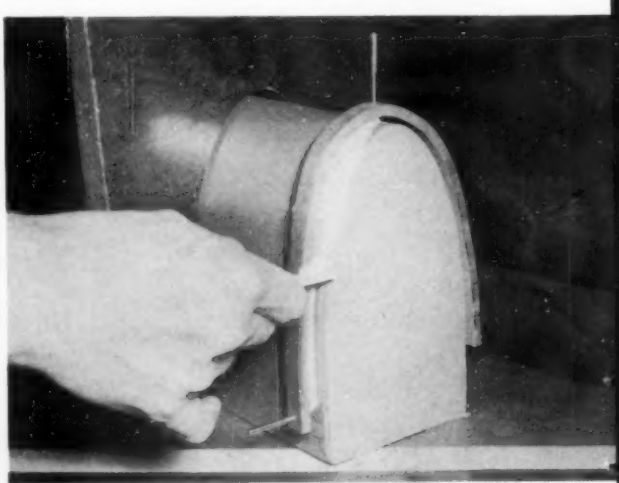


Fig. 2. The surplus resin is removed before allowing the mixture to harden at room temperature.

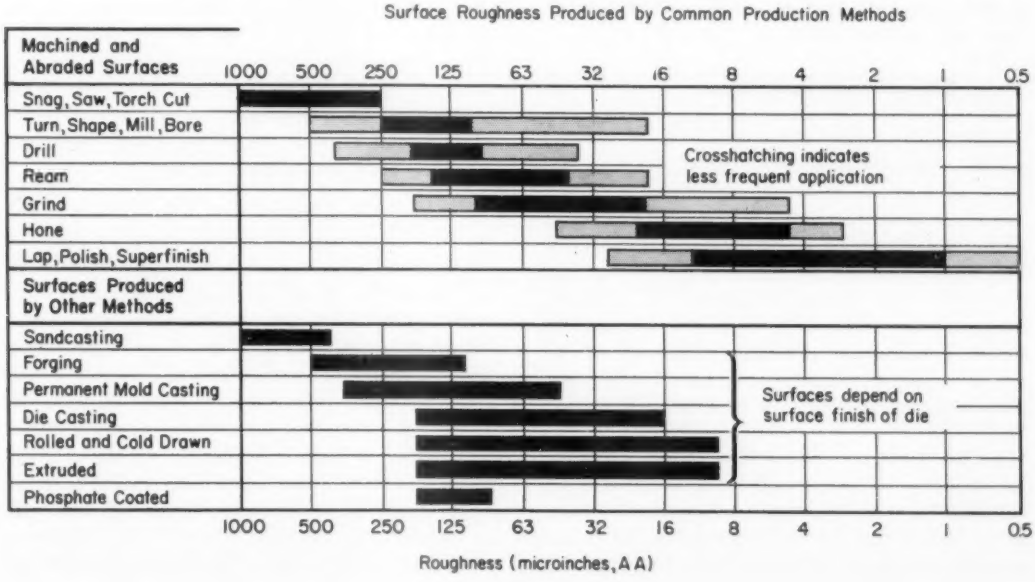
surface finish and stylus instruments

Based on ASA B46.1—1955 and Appendixes

SMOOTHNESS AND ROUGHNESS are relative terms. Identical surfaces may be considered smooth for one purpose and rough for another. In the mechanical field comparatively few surfaces require any control of smoothness beyond that afforded by the processes required to obtain the necessary dimensional characteristics. Control of the surface roughness of such nonworking surfaces as the walls of transmission cases, crankcases or differential housings is seldom necessary except for process control or appearance requirements. However, to obtain optimum mechanical performance, working surfaces of bearings, pistons and gears should be controlled closely. Since unnecessary surface controls may increase production costs, surface characteristics should not be controlled on a drawing or specification unless such control is essential to the appearance or performance of the product. Control of surface finish depends, in large measure, on correct use of instruments whose characteristics and limitations are known.

Production Surfaces: The accompanying table shows the typical range of surface roughness values which may be obtained by various production methods. The ability of a processing operation to produce a specific surface roughness depends on many factors. In surface grinding, for example,

Surface Roughness Produced by Common Production Methods



the final surface depends on the peripheral speed of the wheel, speed of traverse, rate of feed, grit size, bonding material and state of dress of the wheel, amount and type of lubrication at the point of cutting, and physical properties of the piece being ground. A small change in any of these factors can have a marked effect on the surface produced. The values shown on the chart should be considered flexible, not hard and fast limits.

Control Procedures: Several procedures for the control of surface roughness under production conditions are available. Production may be established and controlled by the appearance or feel of the surface, with or without comparison with specimen surfaces, or by instrument reading, with or without comparison with specimen surfaces. Instruments permit the accurate measurement of surfaces obtained in production. Precision reference specimens provide an accurate means of calibrating the measuring instruments.

In addition to these methods of control and inspection, the use of pilot specimens may be expedient for large-scale production. Such specimens are actual production piece parts which have been definitely established as conforming to specified surface requirements by careful checking on instruments calibrated with precision reference specimens. If control is necessary at more than one station, sample specimens may be cut into the required number of pieces. If large quantities are required, electroformed or plastic reference specimens may be satisfactory.

Stylus Type Tracer Instruments

Although a number of instruments for measuring surface roughness have been devised, the large majority of instruments in use depends on electrical amplification of the motion of a stylus perpendicular to the surface over which the stylus is traversed. This motion is translated into a meter reading proportional to the average roughness. In order to reduce confusion caused by lack of consistency in numerical evaluation of surface roughness, specifications related to the design and use of stylus type tracer instruments have been established.

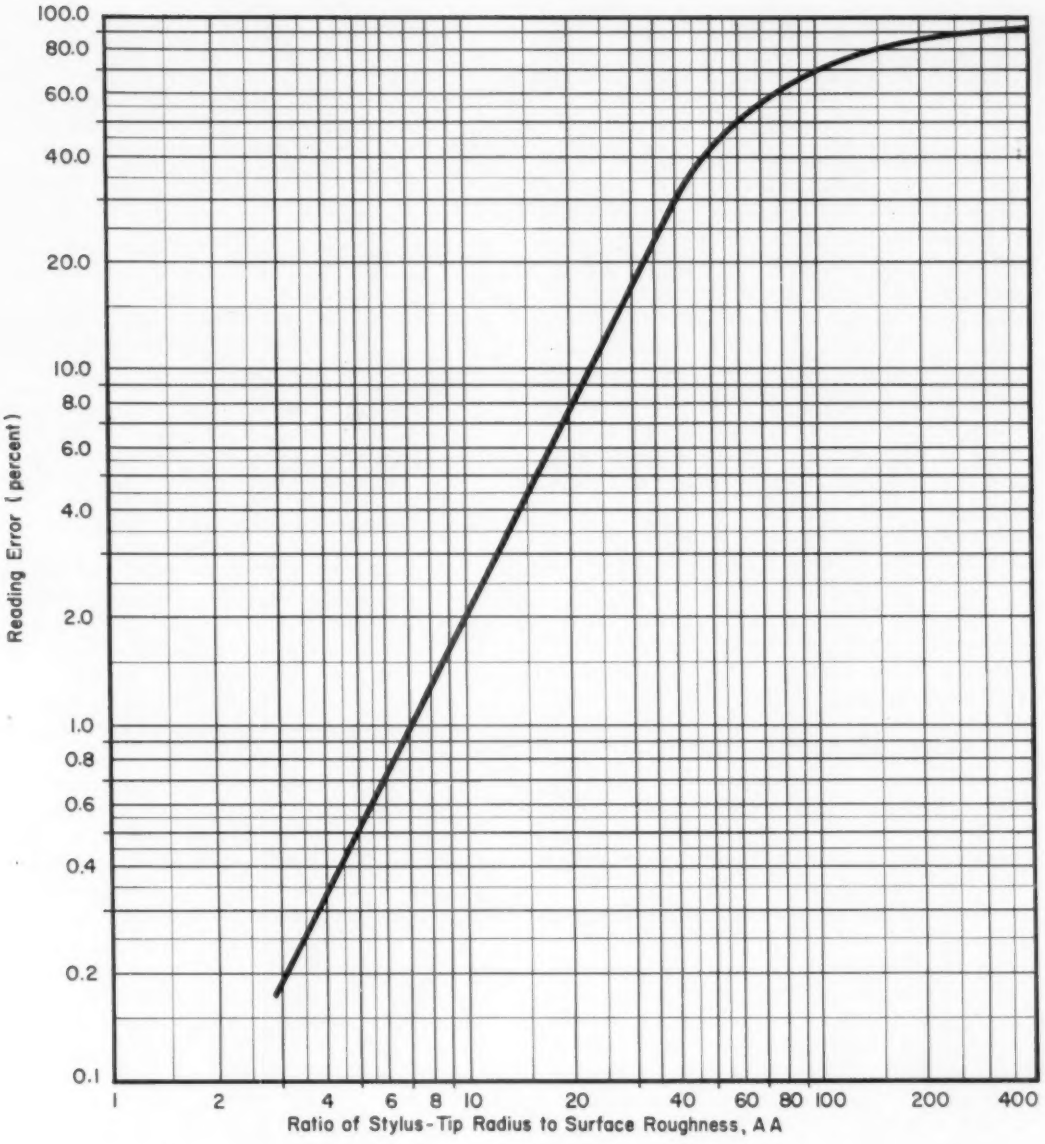
Stylus Design: Stylus dimensions determine the smallness of the irregularities which will be included in a measurement. Experiments have shown that stylus tip radii have little effect on measured roughness values until a radius of about 500 microinches is exceeded. As this radius is increased, errors in measurement gradually become larger. Accordingly, other radii are used only in unusual circumstances, where the 500-microinch radius may not provide the information desired. When other radii are used, they should be chosen from the series 100, 500, 5,000 and 50,000 microinches.

The tip radius for an instrument in satisfactory condition should be within 30 percent or 100 microinches of the nominal value, whichever is greater. Since styli with radii of 500 microinches or less are subject to wear and mechanical damage even when made of the best available materials, it is important that frequent checks of the stylus be made. Cone-shaped styli with tangential spherical tips are considered standard. The nominal included angle of the conical stylus should be 90 degrees. For special applications, however, a chisel point may be desirable.

Stylus Force: If stylus force is too great, it will plow through surface irregularities rather than follow them. For the standard tip radius of 500 microinches, stylus force should not exceed 2.5 grams at any point within the displacement range of the stylus. For special tip radii, the maximum force in grams should not exceed 0.00001 times the square of the tip radius in microinches. The minimum stylus force should be sufficient to maintain contact with the surface under all conditions.

The specified values of stylus force will enable roughness measurements to be made accurately on all but the softest materials, while still allowing a reasonable speed in moving the stylus over the surface. On soft materials, it may be found that the stylus makes a visible mark as it is being used. Such a mark does not necessarily mean that the measurement is incorrect. In extreme cases it may be desirable to make supplementary measurements by other methods. In this way, it is possible to make sure that the penetration of the stylus into the material is small compared to the dimensions of the irregularities being measured.

Tracer Head Supports: A convenient means of providing a reference surface against which to measure stylus movement is to support the tracer containing the stylus on skids having large radii compared to the height and spacing of the irregularities being measured. If the skids have appreciable vertical displacement in moving over a surface, this will be added to or subtracted from the stylus movement, and an erroneous measurement will result. If skids have radii in the direction of the trace of at least eight times the roughness-width cutoff of the instrument, this difficulty will be avoided. If skid radii smaller than eight times cutoff are used, the long wave-length response of



Stylus calibration curve used to indicate the relation between stylus radius and the error in meter reading on any precision reference system.

the instrument may be affected. The radius in a plane perpendicular to the direction of the trace may be of any value to suit the application.

The skids normally supplied with conventional stylus type instruments have too small a radius to provide accurate readings on surfaces rougher than 500 microinches, AA (arithmetic average). In some cases, smaller skids must be used because of space limitations of the surface being measured. In such cases, measurements will generally be correct on all but the rougher surfaces.

The skids or pickup support and the stylus should be in line either in the direction of motion or perpendicular to the direction of motion, or both. The arrangement of skids, or of external reference sources if no skids are used, should be such as to constrain the pickup to move parallel to the nominal surface being measured and to exclude vibration effects.

In measuring surface roughness in small holes, slots and recesses, and on short shoulders, gear teeth and thread surfaces, the geometry may not permit the use of skids to support the tracer. In such cases, the tracer body is supported and moved by a piloting slide, and the tracer stylus is mounted at the end of a suitable beam.

Sampling Length: Since most surfaces are not uniform, differences in instantaneous average readings will occur. A sufficient length of surface must be traversed to ensure that the reading is characteristic of the surface. To provide full readings with specified response times for continuously averaging type instruments, the length of trace (sampling length) used for any given measurement should not be less than 20 times the roughness-width cutoff value. For instruments having meters which indicate integrated roughness over a fixed length of trace, the sampling length should be at least five times the roughness-width cutoff value. When surfaces are not large enough to permit the recommended minimum sampling length, the readings may not be the actual roughness of the surface but may be useful for comparative purposes.

Checking Stylus Radius: As already noted, the stylus radius should be within 30 percent or 100 microinches of its nominal value, or erroneous instrument readings may result. Different methods of checking stylus radius are used, depending on whether or not the instrument used is adjustable. Both methods presuppose that the instrument under test is linear and in good operating condition. Determination of the stylus radius can be accomplished by use of precision reference specimens.

In order to determine stylus radii, instruments with adjustable sensitivity are first adjusted to indicate the correct value of a rough precision reference specimen on which any stylus radius error will have little effect. For a 500-microinch or smaller stylus radius, a specimen of 100 microinches or more is suitable. A reading is then taken on a fine precision reference specimen without readjustment of the instrument. For a 500-microinch stylus radius, the roughness of the specimen used for this second operation should be 20 microinches or less. For styli of smaller radii, finer specimens should be used to accentuate the errors introduced by the stylus radius.

The effective stylus radius may then be found by reference to a curve supplied with the precision reference specimens. This curve shows the relation between the meter reading on the finer specimen and the stylus radius. The effective stylus radius will be that corresponding to the meter reading noted.

A similar method uses the standard stylus calibration curve shown. The relation between stylus radius and the error in meter reading on any precision reference specimen is shown by this curve. The vertical scale is the percentage error in meter reading, i.e., it is 100 times the difference between the roughness of the precision specimen and the indicated roughness, divided by the roughness of the precision specimen. The horizontal scale is the ratio of the effective stylus radius in microinches to the average roughness height of the precision specimen.

EXAMPLE: Determine actual tip radius of stylus with a nominal radius of 500 microinches when used on an adjustable instrument.

SOLUTION: Adjust meter reading to conform to known value of precision roughness specimens with roughness of 100 microinches, AA, or greater. Without further adjustment, take reading on specimen with known roughness of 20 microinches, AA. On this example, a reading of 16 microinches, AA, indicates reading error of 20 percent. From value of 20 percent on vertical scale of calibration curve, read across to curve and down to ratio of 32. Actual tip radius would therefore by 32 times 20 or 640 microinches.

Errors resulting from the use of a stylus of known radius may be found with the calibration curve. In the case of a 500-microinch stylus operating on a 20-microinch specimen, the ratio of tip radius to specimen roughness is 25. For this ratio, the curve indicates a 12 percent error. Accordingly the meter would be expected to read 2.4 microinches low, or about 17.6 microinches.

When it is necessary to check stylus radius on instruments which are not adjustable, readings are taken on rough and fine precision reference specimens. The reading obtained on the fine specimen is multiplied by the ratio of rated roughness to instrument reading on the rough specimen. The resulting value is used as a corrected reading for the fine specimen, and the stylus radius corresponding to it is determined from the calibration curve.

In general, the effect of stylus radius is less pronounced on machined surfaces than on equivalent precision reference specimens.

Interpretation of Readings: An instrument should not be expected to indicate the true roughness on a smooth precision reference specimen. It should read this value less the error caused by the stylus radius. With an adjustable-gain instrument, the gain should not be altered to read the nominal value of the reference surface, but allowance should always be made for the effect of stylus tip radius. If a stylus radius larger than the allowable limits is found, the stylus should be replaced. If an instrument with an oversize stylus is adjusted to read the rated roughness of the precision reference specimen, erroneous readings will result. In using the procedure outlined, care must be taken that the roughness-width cutoff of the instrument is not less than 0.010 for use on the precision reference specimens.


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GOLD MEDALS

Four Gold Medal Awards for outstanding contributions in the field of tool engineering were presented again this year by the American Society of Tool Engineers. Dr. Harry B. Osborn, Jr., retiring ASTE president, made the presentations March 22 at the annual membership banquet in Chicago.

The medals are given annually to promote the science of tool engineering and encourage contributions in the immediate and related fields covered by the activities of the Society. The awards and their recipients are:

ASTE Progress Award, for engineering accomplishments in the field of manufacturing techniques and production methods, to James H. Kindelberger, chairman of the board and chief executive officer, North American Aviation, Inc.

ASTE Gold Medal, for outstanding service through published literature, technical writings or papers, to Professor Orlan W. Boston, chairman of the department of production engineering, University of Michigan.

Joseph A. Siegel Memorial Award, perpetuated by past presidents in memory of the first ASTE president, for contributions through leadership, support or acts of timely benefit to ASTE, to Past Director Edward W. Ernst.

ASTE Engineering Citation, for unusual skill in development of tool engineering principles, to Ralph E. Cross, executive vice president, The Cross Company.

The ASTE Honor Awards Committee, which made the selections, is made up of the nine past presidents who are oldest in terms of office. Walter F. Wagner is chairman of the 1955-56 committee, with Frank W. Curtis as vice chairman. Other members are D. D. Burnside, C. V. Briner, A. H. d'Arcambal, R. H. Morris, J. R. Weaver and A. M. Sargent.

ASTE Progress Award

presented to James H. Kindelberger
chief executive officer,
North American Aviation, Inc.



Chief executive of a leading aircraft manufacturer . . . . . lifelong leader in the development of civilian and military aviation . . . expert in originating advanced techniques for economies and simplification of plane production . . . recipient of highest government civilian service awards.

A man who has devoted his life to turning out better and faster planes for the U. S., Mr. Kindelberger has produced more planes than anyone else in the world. Among his "babies" are the P-51 Mustang, the B-25 Mitchell bomber, the F-86 Sabre jet and the F-100, first jet combat plane able to go through the sound barrier in level flight.

Mr. Kindelberger, who learned to fly in World War I, started as a draftsman with the Glenn L. Martin Company, then switched to Douglas Aircraft Company as vice president and chief engineer. In 1935 he took over as president of North American Aviation, Inc., becoming chairman of the board and chief executive officer in 1948.

An expert in aviation mass production methods, he has advised the U. S. Government in many capacities, was awarded the President's Certificate of Merit and the Air Force Exceptional Civilian Service Award.

ASTE Gold Medal

presented to Orlan W. Boston
chairman, production engineering department,
University of Michigan



Eminent educator in production engineering . . . influential advocate of the industrial importance of tool engineering principles . . . internationally recognized for his many outstanding contributions of technical articles, textbooks, and reports in the fields of metal processing and production methods.

Author of several books and more than 200 papers and articles dealing with metal processing, Prof. Boston has won international notice in the technical publication field. Dissemination of knowledge of cutting and machine tools and allied subjects has been his lifelong interest.

Prof. Boston was instrumental in setting up at the University of Michigan a curriculum in production engineering, the first leading to a Bachelor of Science and Master of Science at a large engineering school.

He has been associated with the University of Michigan, his alma mater, since 1921, becoming full professor in 1926, and chairman of the department of production engineering in 1951. Throughout his career, Prof. Boston has worked to advance the professional standards of tool engineering and to establish engineering curricula in the field.

Joseph A. Siegel Memorial Award



presented to Edward W. Ernst
past director, ASTE

Society Life Member . . . contributor of his immeasurable time and abilities to the Society's technical growth and prestige . . . leader in early establishment of effective standardization practice . . . inspiring founder and administrator of ASTE book publishing activities.



Chairman of the Society's Handbook Committee during the crucial five years leading up to publication of the "Tool Engineers Handbook," Mr. Ernst has given unstintingly of his time and efforts since he became chairman of ASTE's newly founded Schenectady chapter in 1938.

Awarded a life membership for his contributions to the Society, he has also served twice on its National Board of Directors and been chairman of the National Standards Committee.

Mr. Ernst started with the General Electric Company as an office boy in 1911, but soon became a machine apprentice. After gaining wider experience with other firms, he returned to General Electric and was shortly made foreman, then superintendent of the punch press, tool, die and gear department at Schenectady. He is now specialist in machine tool equipment at Appliance Park, Louisville.

ASTE Engineering Citation



presented to Ralph E. Cross
executive vice president,
The Cross Company

Pioneer and leader in the development and application of automation principles to machine tools and manufacturing processes . . . His advocacy of continuous integrated in-line production has accelerated its recognition as a major advancement in tool engineering.



For more than 20 years Mr. Cross has been in the vanguard of the vital trend toward more and more automation. Mass production industries all over the world have benefited from transfer machine and other automatic devices which he pioneered.

In recent years he directed the development of many "firsts" such as a cylinder head line with automatic banking between sections and an electrical memory unit for programming tool changes.

On loan to the Department of Commerce in 1954, he was responsible for the mobilization preparedness of equipment and transportation industries. As a consultant to the Assistant Secretary of the Air Force for Materiel, he is directing the development of a defense reserve of machine tools for the Air Force.



Tooling demonstrations utilizing university engineering facilities, as pictured at left, are an important phase of on-campus conference programs.

On-Campus Conferences Scheduled for April

State University of Iowa and Purdue University to Host Tool Engineers

With spring comes the traditional and popular ASTE educational activity, the on-campus conference. Two are scheduled for the month of April on consecutive week ends when the State University of Iowa stages its second on April 21, and Purdue University holds its fourth such annual event on April 28.

State University of Iowa

"Automation for Small Industry" will be the theme of Iowa's April 21 conference. Co-sponsored by the university's Mechanical Engineering Department and ASTE, the conference will stress the fundamentals of low volume, low cost, low investment automation and mechanization, not the "super colossal" installations.

Components of automation—basic operation, transfer, gaging control, etc.—will be discussed individually, then integrated as a complete system.

Other cooperating organizations will be the Industrial Engineering Association of Iowa, Quad City Association of Industrial Engineers, the Mississippi Valley chapter of the American Institute of Industrial Engineers, the American Society for Metals and the student chapter of American Society of Mechanical Engineers.

Featured speakers will include representatives of Micromatic Hone Corp., Warner & Swasey Co., Buick Motor Division, Snyder Tool & Engineering Co., Michigan Drill Head Co., Mead Specialties Co., and the State University of Iowa.

Also presented will be various company exhibits stressing the applications of practical automation.

A special program for the wives has been planned in cooperation with the university's Home Economics and Art Department.

Inquiries concerning registration should be addressed to Prof. J. Wayne Deegan, Department of Mechanical Engineering, Engineering Bldg., Iowa City, Iowa.

Purdue University

Purdue's conference on Saturday, April 28, will provide some timely answers to the question theme "What Is New in Tooling?" It is sponsored by Purdue's School of Industrial Engineering and Management in cooperation with the Indiana Council of ASTE, the National Education Committee of ASTE, and the Division of Adult Education.

Registration is from 7:15 to 8:15 at Michael Golden Laboratories with special tooling demonstrations planned for the fore part of the morning.

Tentatively scheduled are demonstrations of ceramic material as a turning tool, a tool feedback unit, the Carboloy Machinability Computer, optical tooling, ultrasonic testing, turning polygon shapes on a turret lathe, positioning mechanisms for machine tools, gaging and quality control, and new carbide grades.

A morning panel discussion will be devoted to "Ceramics, Borides and Carbides—Latest Machining Applications" featuring panelists from Norton Co., Carboloy, Warner & Swasey Co., and Minneapolis-Honeywell Regulator Co.

Another panel discussion is slated for the afternoon on the subject "Automation of Machine Tools Today."

Rounding out the day's activities a dinner meeting will be held in the Purdue Union Building. Toastmaster will be Howard C. McMillen, newly elected president of the Society. Chairman of the conference is Orville D. Lascoe, professor of industrial engineering at Purdue and member of the ASTE National Education Committee.

Bulletin

Chicago, Ill. March 23 (By Special Wire)—A dramatic and triumphant week for the American Society of Tool Engineers came to a close today when the final curtain was rung down on ASTE's most successful Exposition and Convention in history.

Attracted by an outstanding display of the latest in manufacturing equipment and methods, production and engineering personnel from all over the United States, Canada and foreign countries attended the Exposition.

Richard J. Daley, mayor of Chicago, in recognition of the importance of ASTE's 1956 Industrial Exposition and Annual Meeting, proclaimed March 19-23 "Tool Engineering Week in Chicago."

NATIONAL OFFICERS ELECTED

In addition to Exposition activities, new national officers of ASTE were elected at the annual meeting of the Board of Directors on March 17. President of the 33,000-member Society is Howard C. McMillen of Bedford, Ind.

Serving with him are:

Harold E. Collins of Houston, Texas, first vice president.
George A. Goodwin of Dayton, Ohio, second vice president.
Wayne Ewing of Los Angeles, third vice president.
H. Dale Long of Chicago, Ill., fourth vice president.
John X. Ryneska of Lynn, Mass., treasurer.
William Moreland of Ashland, Ohio, secretary.

On orders of his physician, Raymond C. W. Peterson of Toledo, third vice president and national director for 1955-56, withdrew from his active role on the national ASTE scene, but will continue as director until October.

New officers were installed by Retiring President Harry B. Osborn, Jr., at the annual membership banquet held in the Grand Ballroom of the Conrad Hilton Hotel on March 22.

DELEGATES ELECT BOARD

New members of the Board of Directors, elected March 22 by the House of Delegates, are:

John X. Ryneska of Lynn, Mass.
Gustave (Ben) Berlien of Oakland, Calif.
Irving H. Buck of Dallas, Texas.
Philip R. Marsilius of Bridgeport, Conn.
Joseph L. Petz of Poughkeepsie, N. Y.
Leslie C. Seager of Salt Lake City, Utah.

Incumbent directors who will serve another term on the ASTE Board of Directors are:

George A. Goodwin of Dayton, Ohio.
William Moreland of Ashland, Ohio.
Charles M. Smillie of Ferndale, Mich.
William A. Thomas of Windsor, Ont., Canada.

All of the newly elected national officers were elected to the Board of Directors.

As provided in the ASTE Constitution, Dr.Osborn as retiring president, automatically becomes the fifteenth member of the Board.

National directors for 1956-57 will be installed and assume duties at the semiannual meeting in October.

GOLD MEDALS PRESENTED

ASTE Gold Medal Awards were presented by the Society to four outstanding men at the annual membership banquet. The ASTE Progress Award was presented to James H. Kindelberger, chief executive officer and chairman of the board, North American Aviation, Inc.; the ASTE Gold Medal was presented to Orlan W. Boston, chairman of the production engineering department, University of Michigan; the Joseph A. Siegel Memorial Award went to Edward W. Ernst, past director of ASTE; and the ASTE Engineering Citation went to Ralph E. Cross, executive vice president of The Cross Co. J. F. Smithson, vice president in charge of engineering for North American, accepted the award for Mr. Kindelberger. (See page 125 of this issue).

EDUCATION AWARDS ANNOUNCED

Another highlight of convention week was the announcement of the ten winners of the 1956-57 International Education Award Winners by Robert E. McKee, chairman of the National Editorial Committee.

Scholarships of $700 each will go to:

Ellis Burnett, Utah State College
Edward J. Buynacek, University of Cincinnati
Donald A. Gutowski, University of Illinois
Theodor W. Haiplik, University of Toronto
Richard W. Hradek, State University of Iowa
Richard A. Hunt, Ohio State University
Roderick S. Hunt, Syracuse University
Gary A. Kinemond,University of Kansas
Alvydas A. Kudirka, University of Connecticut
George A. Roupe, University of Missouri

On-the-spot convention coverage will be a feature of the May issue of THE TOOL ENGINEER.

CONSTITUTION APPROVED

John X. Ryneska, national secretary of the Society for 1955-56, announces that the proposed amendments to the ASTE Constitution, recently submitted as a referendum to the voting members, have been approved by an overwhelming majority of those who voted.

Members are requested to retain the copy,dated March 1956, of the Constitution and Bylaws sent with the ballot, as it is now the official document in which the changes are incorporated.

annual report *by the president*

With the chartering of our 131st chapter and a membership in excess of 33,000, the American Society of Tool Engineers continues its phenomenal growth—unequaled by any other technical society in this country. When one considers that our beginning 24 years ago was on the occasion of a handful of men getting together in Detroit to discuss and share problems and experiences attendant to the even-then need for increasing production and decreasing costs, we have indeed come a long way.

Apart from our efforts to serve our members and maintain our enviable and well-deserved position as a technical society through the activities of our chapters and national committees, we are extending these activities in many directions for the added purpose of achieving undeniable professional recog-



nition for our members and the profession of tool engineering. To this end we must rely on top-grade leadership and experience, be it at the chapter or national level.

Our Society continues its gratifying growth in size and stature for the singular reason that enough of these leaders have had what it takes to accomplish our objectives. These men have maintained a consistently broad and imaginative approach to the many fascinating challenges that are a part of the operation of a technical society such as ours. This leadership has been important in the past and responsible to a large extent for our prosperity. It will be even more vital in the future.

I wish complete documentation of all the work of our various national committees were practical for this report. The men who have worked on them deserve such treatment so that you may know what they have done for you and your Society. However, the summaries contained herein will highlight such activities and indicate the progress of ASTE during the past year.

Membership: Most vital asset of the Society is its membership. Without an active and growing membership, the Society could not possibly work toward its goals of serving the profession and achieving public recognition for the accomplishments of its members. Within the span of twenty-four years the Society has grown to be one of the largest engineering groups in the country. Representing 33,557 members, our roster includes 131 chapters located in strategic industrial areas as shown on the accompanying map. In addition, 12 student chapters serve the tool engineers of the future at our foremost educational institutions.

Since the last Annual Meeting, seven chapters have been installed. These include Oklahoma City, East Texas, Ashtabula, Northwestern Pennsylvania, Centinela Valley, Monmouth, and Elkhart-Goshen. Also, six student chapters have been added, including Wentworth Institute, Franklin Technical Institute, City College of New York, Mohawk Valley Technical Institute, Lawrence Institute of Technology and California State Polytechnic College.

Financial: Existence of the Society and its ability to perform services for its members and industry depend upon finances. No matter how worthy a program may be, it could not be carried out without funds to finance the necessary activi-



ties. The Financial Committee carefully studies financial trends of assets, liabilities, reserves, income and expenses. Comparing budgets and expenses for the current year with those for the previous year, the financial condition of the Society is encouragingly favorable.

The balance sheet for Jan. 31, 1956 included in this report shows total assets of more than $1.6 million, our net worth being over $1.1 million. This represents an increase in net worth of $11,204 during the year. The bar charts for income and expense are represented on a per member basis and over the period of two preceding fiscal years. These charts are represented in this way in order to average the biennial Industrial Exposition on an annual basis.

Based on an average membership for the two-year period of 31,103, services to the profession and to industry amounted to $44.17 for each member. This was accomplished with a per member investment of $7.40, representing a 600 percent return on each member's investment. Compared with corresponding figures for the preceding year, the income per member increased $5.11 while the services increased $7.39 for an average yearly increase in membership of approximately 2,500.

Professional Engineering: This committee aids members interested in professional registration and promotes professional recognition of tool engineering and the Society among other engineers and the public. Most of our chapters have organized PE committees and have commendable programs, including refresher courses, to help members improve their professional status. Such programs are outstandingly characteristic of ASTE because, in this relatively young profession, it works toward improving the engineering stature of all members regardless of educational background.

Objectives of this committee are far reaching and include: Encourage the professional growth of tool engineers whether they become registered or not, promote Society membership in the Engineers Joint Council, plan tool engineering courses for colleges and universities, encourage industry to send employees to school, make refresher courses and preparatory courses available to members, and promote the recognition of the profession.

During Engineers Week, Feb. 20-24, several chapters cooperated actively in planning and organizing programs for observing the week's activities.

Honor Awards: For the second consecutive year, four National Honor Awards are presented at the Annual Meeting to engineers who have served the profession of tool engineering in an outstanding manner. The awards are: ASTE Progress Award, ASTE Gold Medal, Joseph A. Siegel Memorial Award, and Engineering Citation. These impressive awards are presented to each recipient at the annual banquet in recognition of their contributions to our high standard of living. Their achievements have contributed to the tool engineering profession, making it possible to produce more goods for more people at lower cost. Recipients of the medals in 1956 are:

James H. Kindelberger, chairman of the board and chief executive officer North American Aviation Corp. receives the ASTE Progress Award. Mr. Kindelberger has been elected to this citation for accomplishments in the field of manufacturing techniques and production methods.

Orlan W. Boston, chairman, department of production engineering, University of Michigan, receives the ASTE Gold Medal. Prof. Boston has earned this honor for his outstanding service through published literature, technical writings and papers.

Edward W. Ernst, manager, machine tool equipment and planning, Appliance Park, General Electric Co., is honored with the Joseph A. Siegel

AMERICAN SOCIETY OF TOOL ENGINEERS

BALANCE SHEET
JANUARY 31, 1956

ASSETS

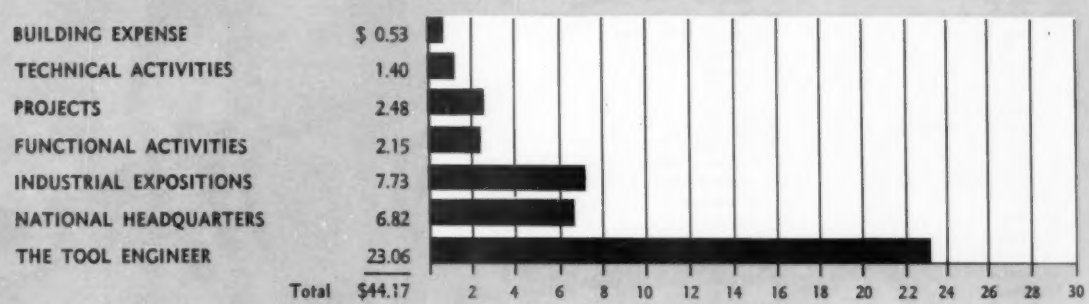
CURRENT ASSETS		
Cash on Hand and in Banks	$ 845,329.28	
Accounts Receivable	43,967.75	
United States and Canadian Bonds	461,048.00	
Inventories	61,244.58	
Total Current Assets		$1,411,589.61
FIXED ASSETS		
Land	$ 40,375.88	
Land Improvements	8,610.21	
Building	131,551.02	
Automobile	2,057.00	
Furniture and Fixtures	62,838.97	
Total Fixed Assets	$ 245,433.08	
OTHER ASSETS		
Deposits with Others	$ 2,521.02	
Travel Advance	2,450.00	
Total Other Assets	$ 4,971.02	
Total Assets	1,661,993.71	

LIABILITIES AND NET WORTH

CURRENT LIABILITIES		
Accounts Payable Chapter	$ 7,719.93	
Accounts Payable Membership Pending	3,546.50	
Accounts Payable Trade	785.72	
Accounts Payable Suspense	103.99	
Prepaid Advertising	2,704.80	
Deposits—Tool Show Registrations	11,600.00	
Deposits—Tool Show Space	526,990.25	
Accrued F. O. A. B.	750.03	
Employees Pension Fund	2,102.14	
Accrued Agency Commission	1,101.00	
Award Deposits	2,245.00	
Total Current Liabilities		$ 559,649.36
NET WORTH		$1,102,344.35
Total Liabilities and Net Worth		$1,661,993.71

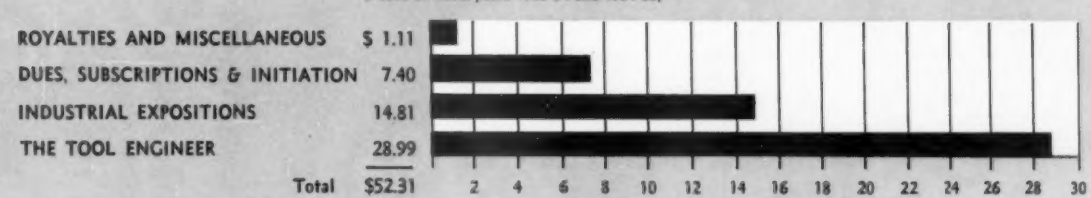
EXPENSES PER MEMBER PER YEAR*

(Based on fiscal years 1953-54 and 1954-55)



INCOME PER MEMBER PER YEAR*

(Based on fiscal years 1953-54 and 1954-55)



*Average membership during period was 31,103

This bar chart for income and expense illustrates the multiple dividends received by each member in addition to invaluable technical information. With an average investment of $7.40, each member received services in various forms from the Society amounting to $44.17, a return of almost 600 percent of his investment in national operations.

In the balance sheet at the top of this page are shown the assets, liabilities and net worth of the Society. This portrays its strong financial structure, its net worth being more than $1 million dollars.

ASTE CHAPTERS

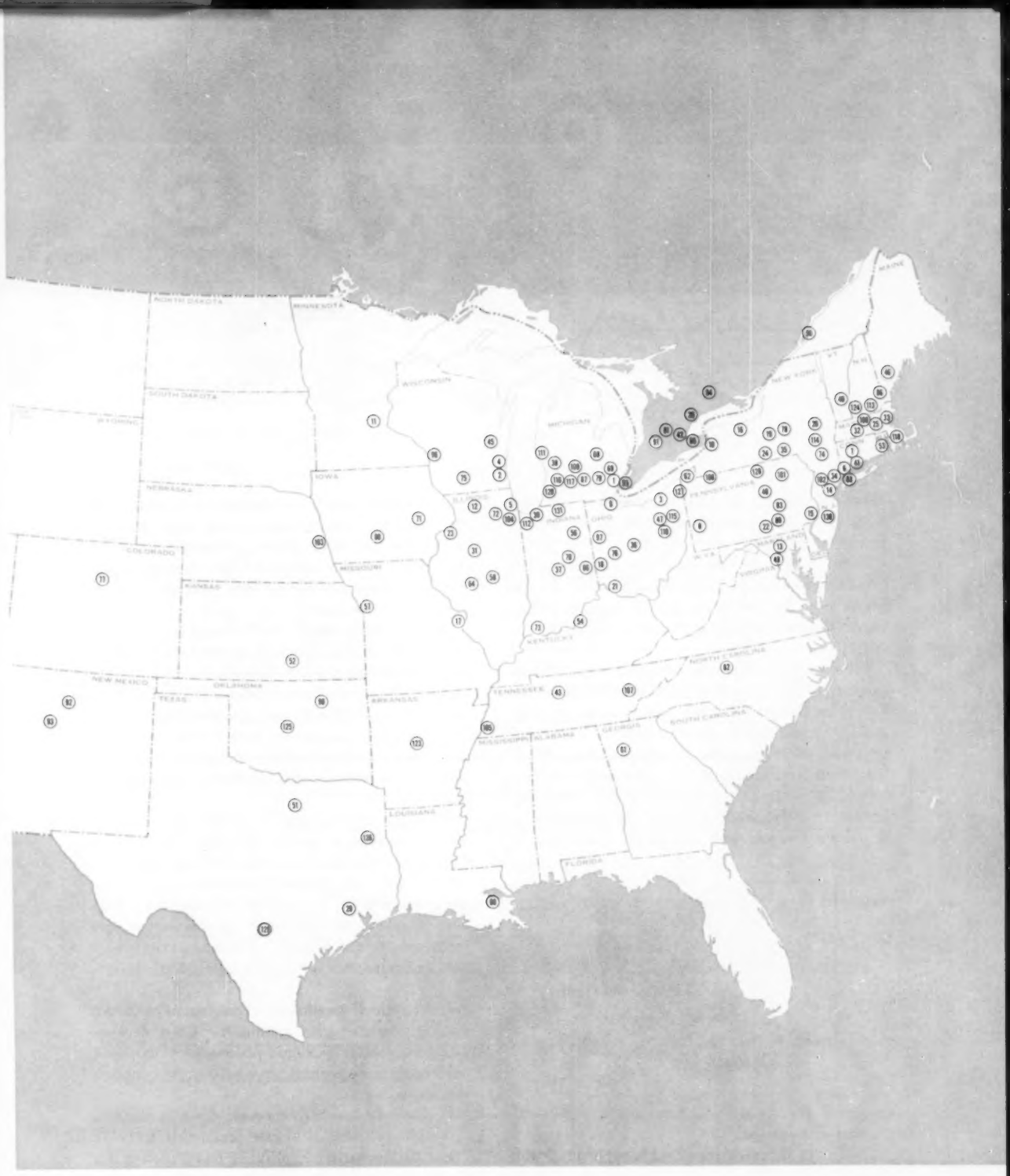
1. Detroit
2. Racine
3. Cleveland
4. Milwaukee
5. Chicago
6. Fairfield County
7. Hartford
8. Pittsburgh
9. Toledo
10. Buffalo-Niagara Frontier
11. Twin Cities
12. Rockford
13. Baltimore
14. Northern New Jersey
15. Philadelphia
16. Rochester
17. St. Louis
18. Dayton
19. Syracuse
20. Schenectady
21. Cincinnati
22. Central Pennsylvania
23. Tri-Cities
24. Elmira
25. Worcester
26. Toronto
27. Los Angeles
28. Golden Gate
29. Houston
30. South Bend
31. Peoria
32. Springfield (Mass.)
33. Boston
34. Greater New York
35. Binghamton
36. Columbus
37. Indianapolis
38. Western Michigan
39. Seattle
40. Twin States
41. New Haven
42. Hamilton
43. Nashville
44. San Diego
45. Fond du Lac
46. Portland (Maine)
47. Akron
48. Potomac
49. Williamsport
50. Montreal
51. North Texas
52. Wichita
53. Little Rhody
54. Louisville
55. Windsor
56. Fort Wayne
57. Kansas City
58. Decatur
59. (Inactive)
60. New Orleans
61. Atlanta
62. Erie
63. Portland (Oregon)
64. Springfield (Illinois)
65. Niagara District
66. Richmond
67. Phoenix
68. Saginaw Valley
69. Pontiac
70. Muncie
71. Cedar Rapids
72. Fox River Valley
73. Evansville
74. Mid-Hudson
75. Madison
76. Springfield (Ohio)
77. Denver
78. Mohawk Valley
79. Ann Arbor Area
80. Des Moines
81. Grand River Valley
82. Piedmont
83. Lehigh Valley
84. Long Beach
85. Salt Lake City
86. Granite State
87. Jackson
88. Long Island
89. Greater Lancaster
90. Tulsa
91. London-St. Thomas
92. Los Alamos
93. Albuquerque
94. Peterborough
95. San Gabriel Valley
96. La Crosse
97. Lima
98. Santa Clara Valley
99. San Fernando Valley
100. Northern Massachusetts
101. Keystone
102. Paterson
103. Nebraska
104. Louis Joliet
105. Memphis
106. Tucson
107. Knoxville-Oak Ridge
108. Chautauqua-Warren
109. Lansing
110. Canton
111. Muskegon
112. Calumet Area
113. Merrimack Valley
114. Hendrick Hudson
115. Western Reserve
116. Kalamazoo
117. Battle Creek
118. Southeastern Massachusett
119. Santa Ana Valley
120. Benton Harbor-St. Joseph
121. San Antonio
122. Riverside
123. Little Rock
124. Monadnock
125. Oklahoma City
126. East Texas
127. Ashtabula County
128. Northwestern Pennsylvania
129. Centinela Valley
130. Monmouth
131. Elkhart-Goshen



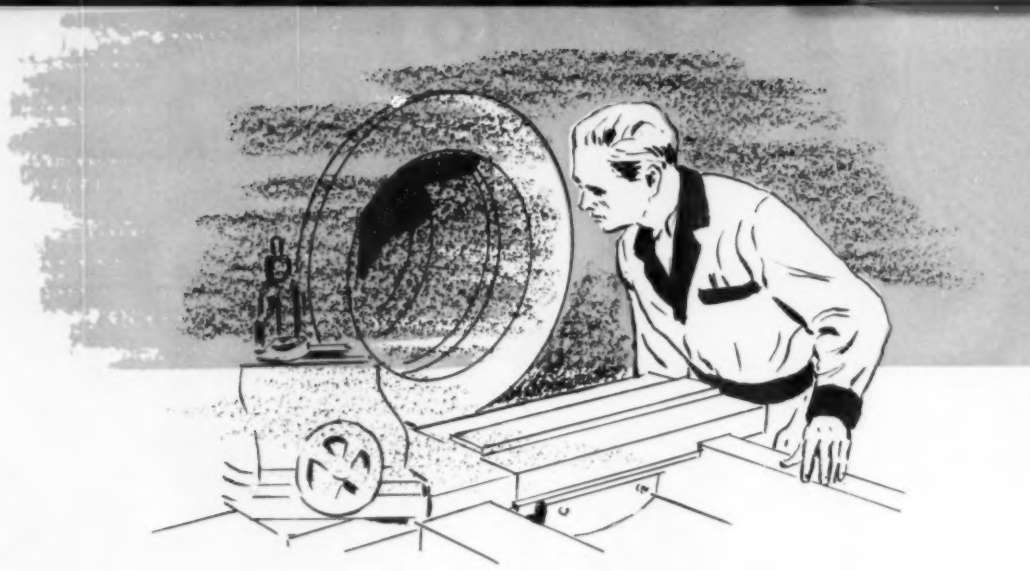
STUDENT CHAPTERS

1. University of Michigan
2. Utah State College
3. University of Kansas
4. Wayne University
5. Alfred State Technical Institute
6. Purdue University
7. Wentworth Institute
8. Franklin Technical Institute
9. City College of New York
10. Mohawk Valley Technical Institute
11. Lawrence Institute of Technology
12. California State Polytechnic College

131 SOCIETY



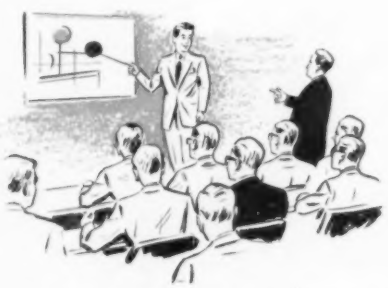
CHAPTERS SERVE STRATEGIC INDUSTRIAL AREAS



Memorial Award for his contributions through leadership, voluntary support and timely acts of benefit to the Society.

Ralph E. Cross, executive vice president, The Cross Co., receives the Engineering Citation. He has been chosen for this honor for his unusual skill in the development of tool engineering principles.

Education: On-Campus Conferences and student chapters continue to be important activities of the Education Committee. Such conferences were held during the past year at the University of Wisconsin, University of Illinois, San Jose State College, Michigan State University, M.I.T., University of Tennessee, University of Mississippi, Purdue University, University of Houston. Although the conference at Wisconsin was not sponsored by the Committee, it



supported the meeting. All programs were well planned and successful.

Eleven conferences are either scheduled or planned for the next year. These include State University of Iowa, Purdue University, North Carolina State College, University of Toledo, Northeastern University, University of Toronto, Washington University, Syracuse University, University of Detroit, Mt. San Antonio College and Wayne University.

Over 600 student members have been added to our Society through the chartering of twelve student chapters, six of them having been chartered within the past year. These chapters are located at technical institutes and universities that give training in tool engineering subjects, and are listed on the map in this report.

The challenge which the increasing complexity of modern industry presents to industrial management emphasizes the role of engineering in today's successful manufacturing enterprise. Dependence on engineers for the proper conduct of manufacturing operations is apparent, first, in the creation of the manufacturing facilities themselves, and second, in the efficient and profitable utilization of such facilities.

Realizing the importance of this situation and its implications, a survey has been completed at Lehigh University, University of Texas, University of Michigan and Purdue University relative to the positions held by mechanical and industrial engineering graduates. The results of this survey were presented at the Regional Educators Conference held in conjunction with the Annual Meeting.

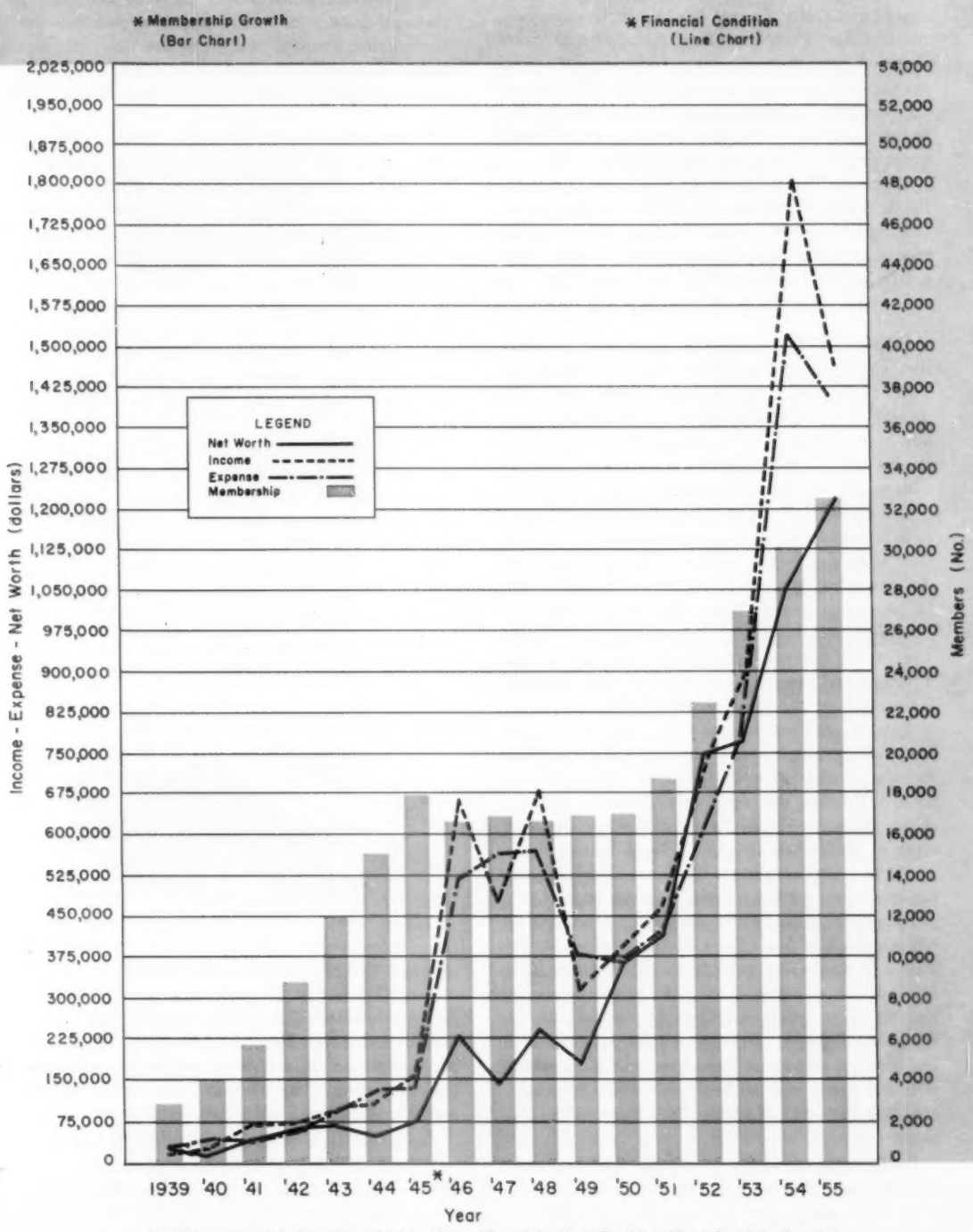
Industrial Expositions: These shows, at which leading manufacturers exhibit the latest developments in tooling, machines, processes and methods, have taken their rightful place among the country's best expositions.

Conducted biennially, they aid the tool engineer in keeping abreast of newest production methods. The 1956 Industrial Exposition had "Tooling for Tomorrow" as its theme and was the largest show in the Society's history. Over 500 exhibitors displayed their products in the expanded facilities of the Chicago International Amphitheatre. The entire show was on the main-floor level.

Conducted as a regional show, the Western Industrial Exposition at Los Angeles in March 1955 was the first full-scale regional show of the Society.

SOCIETY GROWTH AT A GLANCE

1939-1955



* 1945 represents only 9 months as Society changed from Calendar to Fiscal Year (Oct 1- Sept 30) accounting

Patterned after the biennial Exposition, this show proved highly successful and attracted 275 exhibitors. The enthusiasm with which the members greeted this show indicates the need for such expositions to aid the tool engineer in his work.

Programs: The technical program and plant tours for the 24th Annual Meeting in Chicago were planned for a record attendance. The program included more than 60 papers, featuring a diamond symposium, panel discussions, papers and forums on the latest production methods. All daytime technical sessions were scheduled in rooms adjacent to the exhibit area in the Amphitheatre.

Recently, the prepared technical program entitled, "The Forces in Single-Point Tool Metal-Cutting" has been made available to industrial plants and educational institutions. Results were gratifying and necessitated replacement of the slides with strip film to fill requests.

Editorial: This committee concentrates its active attention on evaluating the performance of THE TOOL ENGINEER magazine, developing new sources of technical information, encouraging chapters in the interests of chapter news coverage, and strengthening the liaison between other committees with respect to editorial coverage.

Growth of THE TOOL ENGINEER has kept pace with the steady increase in Society membership. In Dec. 1949, the Society took over the publication of the magazine as a staff function. Since then the magazine has grown from a liability to a tremendous asset and is an acclaimed leader in the field. The poster covers, better layout, art work, line drawings and two-color printing have improved the appearance of the book tremendously.

Average number of pages of paid advertising per issue has increased from 76 in 1950 to 191 in 1955. Average number of editorial pages increased from 65 to 119 during the same period. Further analysis shows the pages for the Technical Section increased from 37 to 55 and the ASTE News Section from 14 to 23. The numerous "back of book" departments account for the remainder of the pages.

To achieve these results required an increase in editorial staff of five editors during this period, the staff now numbering ten editors. The March 1956 issue, which was the Show and Convention issue, was the largest ever published by the Society. It contains 546 pages. The March 1955 issue featured the Western Industrial Exposition and Convention with 402 pages and the September 1955 issue covered the National Machine Tool Show with 430 pages.

During the last year 38 of the 122 technical articles were authored by ASTE members. In addition, 26 of the gadget articles were submitted by members. Also, 43 technical articles and other features were reprinted in quantities up to 11,000 with a grand total of 151,300 reprints distributed by other organizations. Many articles have been reprinted by Government agencies and by European magazines.

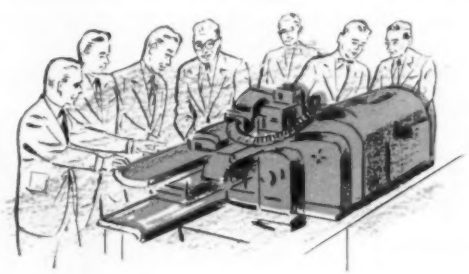
The ASTE News Section has kept the membership posted on important projects and events through feature articles. Rapid growth of the Society and limited space in the News Section make it necessary to give more consideration to unusual chapter activities.

Standards: Since Regional Councils were formed last spring for Chapter Standards Committees, standards activities are increasing at the chapter level. It is planned to have these councils lay the groundwork for standadization in specific fields.

Sixty-four chapters are currently reviewing ASA standards and making suggestions for improvements from the viewpoint of tool engineering. Review projects have thus far been completed by twelve chapters. Primarily because of the interest which has been aroused by this project, there are only four chapters which do not have standards committees.

The National Standards Committee is represented on the ASA Standards Council, the Mechanical Standards Board, the Graphic Standards Board and the Conference of Executives of Organization members. For ASA, it is the administrative sponsor for B67, Industrial Diamonds and Accessories for Their Use. A standard on Diamond Dressing Tools is in the final stages of preparation.

The committee also sponsors B52, Classification of Materials for Tools, Fixtures and Gages. It co-



sponsors B5, Small Tools and Machine Tool Elements. In addition, it is represented on ten other ASA committees. Through its subcommittee a proposed standard on Single Point Carbide Tools has been developed. Also, this committee is now working on a standard for carbide "throwaway" blanks and their holders.

The ASTE Data Sheet Numerical Index has been published in revised and enlarged form. This booklet contains a numerical and alphabetical index of products.

Because national standards are developed by

many groups working together, NSC is in direct contact with many national societies and trade associations in this important work.

Books: Since authorization of a 5-year expanded book publishing program at the last semiannual meeting, the National Book Committee and headquarters staff have been busy organizing for this activity. The staff has been planning the *Tool Engineers Handbook* revision, energizing Chapter Book Committees, surveying possibilities for new



books, and investigating potentials for author and reviewer pools.

Promising to be equally successful as the first edition of the *Tool Engineers Handbook* which has 75,000 copies in use, the *Die Design Handbook* sold out the first printing of 10,000 copies in 5 months. The second printing of the same quantity may not last much longer.

For revision of the *Tool Engineers Handbook*, 250 men were selected to form 26 author groups. Many conferences of these groups have been held and active revision is well under way. Manuscripts for two sections have already been written.

Plans are under way for other books. Subjects under consideration for books include tooling and planning for powder metal parts, production planning and estimating, tolerancing for products and their manufacture, tooling with and for plastics, and machining with carbides.

Research: In its second year of operation, the Research Fund continues to increase in its activities and in its acceptance by industry. To aid in this work, outstanding authorities in industry have generously given their time and the benefit of their experience for guiding the various steering committees and subcommittees of each research project.

Currently, there are seven projects under way, each guided by committees to direct and review progress of the work. These projects include: Mist application of cutting fluids, plastic tooling, metal-cutting, punch and die clearances, metal boride cutting tools, metal-cutting bibliography, and temperature distribution during metal-cutting.

Two of the technical reports resulting from these projects have been used as papers at the 24th Annual Meeting. Also, the Research Fund's activities indirectly assisted in providing three more of the papers for this year's meeting.

With this progress in two years, the research program promises to contribute outstanding and worth-while information to industry.

Constitution and Bylaws: Occasionally, even the best of constitutions requires review for the purpose of making it fit changing times and requirements of the organization it serves. Fortunately, in ASTE, this does not happen often. During the past year a referendum ballot for a revised constitution was submitted to the members and chapters. Although the official count has not been completed at the time of this report, indications are that the chapters have approved the revision by 90 percent and the membership by 98 percent of those voting.

In addition to printing the Constitution and Bylaws, National Procedures and Chapter Procedures have each been printed separately in revised form.

Public Relations: Increasing recognition being gained by the Society is due in a large measure to the work of the Public Relations Committee. This group supplies information and interprets the Society's aims and objectives to the many channels which form public and professional opinion. In keeping with the growth of the Society a full-time headquarters staff has been organized during the past year to fulfill the needs of the Society.

In addition to regular operations, a full-scale colored movie with sound is being produced under the leadership of this Committee. This film will portray to industry, educators and the public the growing importance of tool engineering, its services and the contributions of the profession to the public welfare. In addition to enhancing the stature of the profession in the eyes of the public, the film will make tool engineers proud of their accomplishments and will attract potential engineers to the profession.

Conclusion: Never before in the history of our Society have things progressed as smoothly as during the past year. I am indeed fortunate to have served as president during such a period. Being president has carried with it the personal pride and satisfaction that naturally goes with being the head of an organization of over 33,000 members. But more important to me has been the opportunity it has afforded to meet and to know so many of my fellow tool engineers—the men primarily responsible for the high standard of living in this great country of ours.

Submitted for and on behalf of the
Board of Directors and National Officers

W. B. Osborn Jr.

President and Chairman of the Board



T. W. Black



Frances Little

Editors Added to *Tool Engineer* Staff

Two recent appointments to the editorial staff of THE TOOL ENGINEER have been announced by John W. Greve, editor of the magazine. Theodore W. Black has been appointed to a newly created position of assistant editor, and Frances A. Little has been named an assistant news editor of the ASTE News Section.

Mr. Black, a graduate of the University of Minnesota, was formerly unit supervisor in charge of special reports and presentations for the manufacturing staff at Ford Motor Co., Dearborn, Mich. He joined Ford in 1951 as a methods engineer at the Plastics and Machining Plant.

Mr. Black's experience also covers two years as a time-study engineer with the Murray Corporation of America. Wartime service with the United States Army included two years of mechanical engineering study at the University of California and more than two years of combat in the European Theater of Operations where he was awarded several decorations.

As assistant editor, Mr. Black will be responsible for writing and editing articles for several sections of the magazine.

Miss Little, who was graduated from the University of Michigan, has been associated for the past two years with the public relations division of Michigan Blue Cross-Blue Shield in Detroit. A staff writer in the news department, she prepared releases for use in the metropolitan and weekly press and also wrote news articles for the organization's house publication. Special assignments sent her into the 'field' to compile data and later complete the writing and editing of popular interest feature articles.

Before joining Blue Cross, Miss Little was with the public relations department in the Montana Fish and Game Department and a reporter for a daily newspaper in Montana. She is a native of Andover, Mass., and as assistant news editor will cover both chapter and national activities of ASTE.

Standards Group Announces Publication of Revised Data Sheet Numerical Index

Publication of a revised Data Sheet Numerical Index, adapted from the U. S. Standard Commodity Classification System, has been announced by the National Standards Committee of the Society.

ASTE pioneered in compiling and publishing a sound and systematic classification of products of interest to the tool engineer. Designed by tool engineers for tool engineers' use, the ASTE Index is an invaluable asset in selecting, filing, classifying, and comparing all available tool engineering products quickly and accurately.

While the Index is primarily intended to establish a comprehensive system by which ASTE Data Sheets and related information may be filed (it is not a listing of available Data Sheets), it serves a dual purpose. Of equal importance to its principal function is the fact that it can also be used to number and file the mass of engineering information and data that constantly accumulates. Articles, tables, or data can be numbered and filed for easy reference.

The revised Index will incorporate more than four times as many product entries and a complete breakdown of items within the category of special interest to the tool engineer.

Although the numbering is different, the Index works in the same manner as the decimal system used by libraries the world over. Every item or class of item is given a specific seven figure number. The first two numbers represent the group. This is followed by a dash and five more numbers which break down systematically into subclassifications. Under each group there are 90,000 classified and interrelated numbers available.

The ASTE Index comes in two parts: (1) The Numerical Listing—which is abridged, but shows the basic structure and logic of the ASTE Edition of the U. S. Standard Commodity Classification, and (2) The Alphabetical Listing—which is merely a cross reference index of the same numerical material expanded for the specialized use of the tool engineer.

Inquiries should be directed to: National Standards Committee, American Society of Tool Engineers, 10700 Puritan Avenue, Detroit 38, Michigan.

Positions Available

DESIGNERS—opportunity in development and design of equipment for processing and handling of sheet metal parts. Permanent position with one of the nation's finest design and build jobbing shops. Write to Koppy Tool & Die Co., 1530 Farrow Ave., Ferndale 20, Mich.

MANUFACTURING ENGINEER, TOOL ENGINEERS, DESIGNERS—expanding and progressive company located in smog-free area of L. A. has limited number of openings for top-notch tooling men with mass production experience. Outstanding vacation and insurance benefits, liberal profit-sharing retirement plan. Moving expenses will be paid for those selected. MANUFACTURING ENGINEER must have experience in cost-reduction programs, make machine selections on new and current projects, suggest design changes. TOOL ENGINEERS AND DESIGNERS must have experience in designing production tools, jigs, fixtures, dies and multi-purpose equipment. Salaries open. All inquiries acknowledged and further information furnished. Send detailed resume and salary requirements to L. S. Peck, McCulloch Motors Corp., 6101 West Century Blvd., Los Angeles 45, Calif.

SALES ENGINEERS AND DEVELOPMENT ENGINEERS—long established central New England machine tool manufacturer has openings for sales proposal and development engineers. Sound opportunities for men with engineering background experienced in machine tools or closely allied fields. Salaries open; advancement dependent on demonstrated ability. Liberal vacation and benefit program provided. For further information, send complete details of background to Box 063, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

SMALL MANUFACTURER—is looking for a business partner interested in forming small company. Business established 9 years with scattered distribution in U. S. Has been one-man operation. Product sold to public utilities, appliance dealers, hardware and plumbing trade. Would like associate age 40-55 with machine shop manufacturing experience to operate and supervise automatic screw machines. Knowledge of toolmaking, engineering and machinery design necessary. Investment of $10,000 upwards required. Located 250 miles west of Chicago. Business cannot be relocated. Write to Box 071, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.



Racine ASTE officers for the coming year include, seated from left: LaVerne Hicks, first vice chairman; V. T. Thomas, chairman; and B. L. Peterson, treasurer. Standing are J. D. Vernon, secretary, and R. N. Freres, national delegate.

Guiding activities of the Pittsburgh chapter, from left, are: Chairman E. W. Phillips, Secretary R. J. Zale, First Vice Chairman J. A. Bircher, Treasurer W. B. Coles, and Second Vice Chairman W. B. Kiefer.



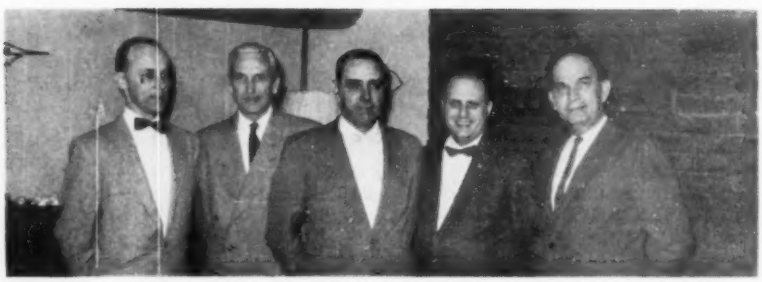
1956-57

CHAPTER officers

An appeal from the ASTE News Editors for photographs of newly elected chapter officers has received such enthusiastic support that this section of 20 pages is devoted exclusively to election coverage. Other chapter activities usually included in ASTE News will be covered in May.



Elected to Cincinnati's highest offices, front row from left, were: Second Vice Chairman J. T. Steinhoff, Chairman Max Kronenberg, First Vice Chairman M. A. Duff, Jr., and (back row) Secretary B. H. Rusk, Treasurer Frank Huston and Delegate J. H. Elfring.



Merrimack officers, from left, include: Second Vice Chairman A. E. Clements, First Vice Chairman R. M. Smith, Chairman E. P. Leavitt, Delegate F. T. Goodwin, and Treasurer J. L. Hanley. R. L. Draper, not pictured, is secretary.



In charge of ASTE events at Decatur, Ill., are (front row): John W. Stein, second vice chairman; W. E. Weatherholt, treasurer; B. H. Ball, first vice chairman. Second row: S. T. Henricks, alternate delegate; A. P. Grant, secretary; W. J. Jahr, chairman; and A. R. Gatts, national delegate.

ASTE activities for Mid-Hudson chapter will be conducted by the officers pictured below. The front row shows: J. Harry Keller, first vice chairman; Frank Plotnik, chairman; and R. A. Boice, second vice chairman. In the back row are C. Morgan Newbury, treasurer, and Michael N. Hall, secretary.





Ladies' night activities and the election of officers were combined at a meeting of Chautauqua-Warren chapter. Shown here, from left: Mr. and Mrs. C. A. Bergquist (assistant secretary-treasurer), Mr. and Mrs. E. W. Garrison (treasurer), Mr. and Mrs. C. L. Douglas (chairman), Mr. and Mrs. L. H. Beau Jean (first vice chairman), Mr. and Mrs. L. R. Green (second vice chairman), and Mr. and Mrs. C. D. Seekins (secretary).



Technical speaker R. H. Dunn, third from right, is pictured with newly elected Williamsport officers. From left: Second Vice Chairman William Beach, Chairman George Lunt, Treasurer Robert Davis, Mr. Dunn, First Vice Chairman Dale Chubb, and Secretary Lester Zimmerman.



Atlanta chapter will be served during 1956-57 by: H. K. Reaves, second vice chairman; John Morris, chairman; R. E. Young, delegate; J. M. Edison, first vice chairman; and W. R. Cosper, Jr., secretary. A. C. Ferguson, not pictured, is the new treasurer.

new chapter officers



New officers of St. Louis chapter for the coming year are, from left: Phil R. Hoffman, treasurer; William G. Bachman, secretary; C. A. Brown, second vice chairman; Vincent L. Bene, first vice chairman; and Clarence Hall, chairman.



LaCrosse chaptér's newly elected officers, shown as they discuss a die on a milling machine in the Trane Co. tool room, are, from left: Sidney Wall, secretary; J. W. Hopkins, chairman and alternate delegate; R. N. Phillips, immediate past chairman and delegate; Elden Bruha, second vice chairman; L. H. Kintzler, treasurer; and Velmor Rohde, first vice chairman.

Officers of Centinela Valley chapter for 1956-57, from left, are: Paul Saxman, alternate delegate; William Keller, treasurer; Larry Forster, secretary; John W. Walti, second vice chairman; John W. Rose, first vice chairman; Vernon R. Powell, chairman; William B. Mackay, 1955-56 chairman.

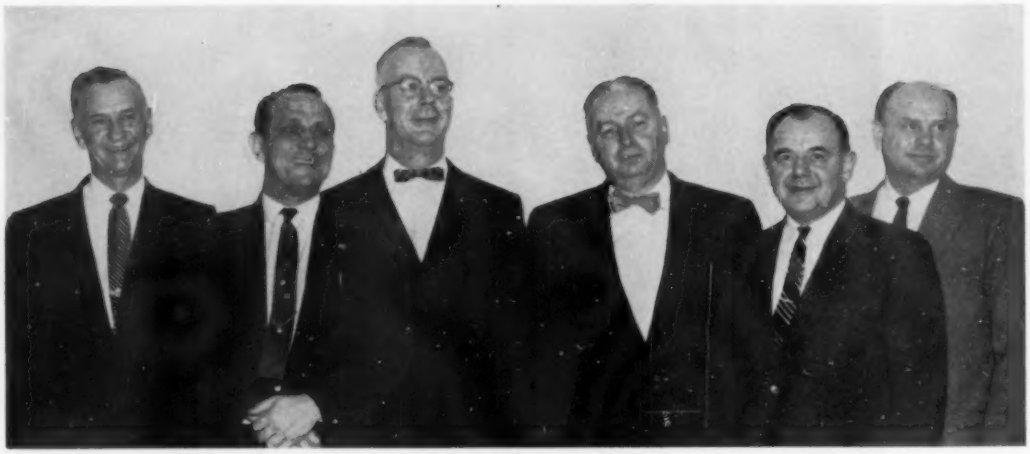




Springfield, Ill., chapter's retiring chairman, Charles A. Woodcock (third from left) is shown wishing success to the newly elected chairman, Paul F. Dirksen. Looking on are the other incoming officers, from left: Donald A. Korte, secretary; Ernest R. Otto, treasurer; Ross A. McNutt, first vice chairman; and Forrest D. Hodge, second vice chairman.

New officers of Cleveland chapter are shown being sworn in by Past Chairman Charles Scheihing, far left. From left, the officers are: Howard C. Noll, chairman and alternate delegate; Pat Taverna, first vice chairman; Carl J. Leska, second vice chairman; Herb D. Groth, third vice chairman; Martin George, secretary; Andrew B. Cirbus, delegate; and Robert Snippel, treasurer.





Piedmont chapter's official responsibilities will be taken on by these new officers who are, from left: E. J. Zagora, second vice chairman; Albert Fairchild, retiring chairman and delegate; H. I. Newsome, first vice chairman; Richard Calvert, secretary; Robert Schneider, third vice chairman; and E. M. Ketchie, chairman. Treasurer Roy Palmer was missing from the picture.



Leading Louisville chapter members for the coming year will be: from left, George Hopkins, treasurer; J. C. Cleveland, secretary; J. J. Schell, second vice chairman; Robert Wohlhueter, first vice chairman; J. R. Davis, chairman and alternate; and J. I. Krumpelman, past chairman and national delegate.

Heading up the Milwaukee chapter for the 1956-57 term will be, from left: Harvey Prill, secretary; L. A. Wacker, second vice chairman; R. H. Bates, treasurer; George Riordan, first vice chairman; and R. W. Lund, chapter chairman.





Officers of Louis Joliet chapter are: R. Eken, second vice chairman; D. Briggs, first vice chairman; H. Zierke, chairman; P. Wasser, secretary; R. Derlinga, treasurer; and "Doc" Bowers, delegate.



Serving the Tulsa chapter for the coming term is this slate of 1956-57 officers. From left are: Sam Collier, chairman; Joe Morrow, first vice chairman; Wayne Cosan, second vice chairman; Paul Muratet, secretary; and Carl Plummer, treasurer.



Southeastern Massachusetts officers, from left, are: Merrill Hunt, Jr., second vice chairman; John Cieplick, first vice chairman; Malcolm A. MacLean, secretary; Ralph E. Manchester, chairman; Raymond E. Holbrook, delegate; and Carroll C. Stevens, treasurer.



Leading Los Angeles chapter for the new term will be: from left, F. X. Bale, chairman; P. E. Lenk, first vice chairman; B. J. Hazewinkel, second vice chairman; A. E. Beaumont, secretary; G. E. Tilden, treasurer; and P. B. Slater, national delegate.

New executive slate for the Montreal chapter includes, seated from left: Sam Fromson, secretary; J. Harold Currie, chairman; Thomas J. Tracey, delegate; and Fred C. Henderson, treasurer. Standing are: James F. Dodge, third vice chairman; C. Grinstead; T. G. Nashman, second vice chairman.



new chapter officers



Santa Clara Valley chapter's new slate of officers, from left, are: Hod Holt, second vice chairman; John Groves, secretary; William T. Wright, chairman and alternate delegate being congratulated by Frank Menard, retiring chairman and delegate; and Paul Sturm, treasurer. Not pictured is Dr. L. H. Cook, first vice chairman.



Leading Muncie chapter's activities for the year 1956-57 are, from left: seated, Don C. Wedlick, chairman; Vynul D. Eley, immediate past chairman and delegate. Standing: Lester Lotz, second vice chairman; Clark Spangler, secretary; Emmett Blocher, first vice chairman; and N. F. Wilson, treasurer.



New officers of Grand River Valley chapter for the coming year are, from left: J. G. Johnstone, secretary; R. L. Robertson, third vice chairman; C. Henderson, chairman; G. M. Dilly, first vice chairman; P. G. Bowman, second vice chairman; and W. C. Little, treasurer.

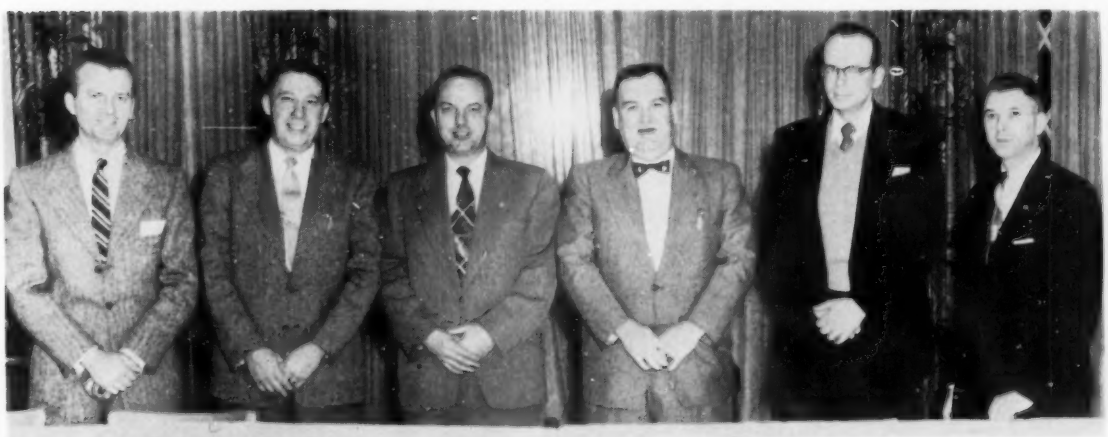


Newly elected officers of Long Beach chapter for the year 1956-57 are shown above, from left: Ray E. Gariss, chairman and alternate delegate; Jim H. Medford, first vice chairman; Charles W. Ward, second vice chairman; Jack B. Irby, secretary; Gene C. Allen, treasurer; Larry D. Pomerantz, retiring chairman and national delegate.



Kansas City chapter's officers for the coming year, elected at their February meeting, are, from left: Joe Gardner, secretary; Ralph Adkins, first vice chairman; Winton Jensen, chairman; Dan Anderson, treasurer; Gary J. Schroeder, immediate past chairman; Harold W. Buddenbohm, delegate. Not present when the picture was taken: Don Flick, second vice chairman.

Officers of Central Pennsylvania chapter for the 1956-57 term, pictured after the election at their February meeting, are, from left: Harold B. Berra, first vice chairman; Elton T. Wenrich, chairman; J. George Williams, second vice chairman; Donald W. Rohrer, secretary; Donald B. Spatz, delegate; Raymond H. Meckley, alternate. Lewis D. Roberts, treasurer, was not present.





Calumet Area chapter's new officers for the coming year are, from left: R. J. Helton, second vice chairman; Leonard Guziar, treasurer; Dave MacGregor, chairman; Dave S. Lambie, first vice chairman; and L. W. Montgomery, secretary.



The 1956-57 officers of Benton Harbor-St. Joseph chapter, elected at their meeting at Schuler's Restaurant, are, from left: Calvin Frappier, treasurer; Robert Potter, secretary; Paul Broadstone, second vice chairman; Ivan Peters, chairman; and Fred Lindenmeyer, first vice chairman.

The newly elected slate of officers of Greater Lancaster chapter, from left, are: Theodore E. Morrison, chairman; John Folkeson, first vice chairman; John W. Morrison, second vice chairman; Martin Sensenig, delegate; John G. Fish, secretary; Ralph F. Wolf, assistant secretary. Not pictured: Victor B. Hensel, treasurer, and Robert C. Ressler, assistant delegate.



Columbus chapter's recently elected officers for the coming 1956-57 term are, from left: W. W. Hudson, chairman; Carl P. Hooge, first vice chairman; Archer B. Jones, second vice chairman; Robert E. Snider, secretary; and Carl J. Winkleman, treasurer.





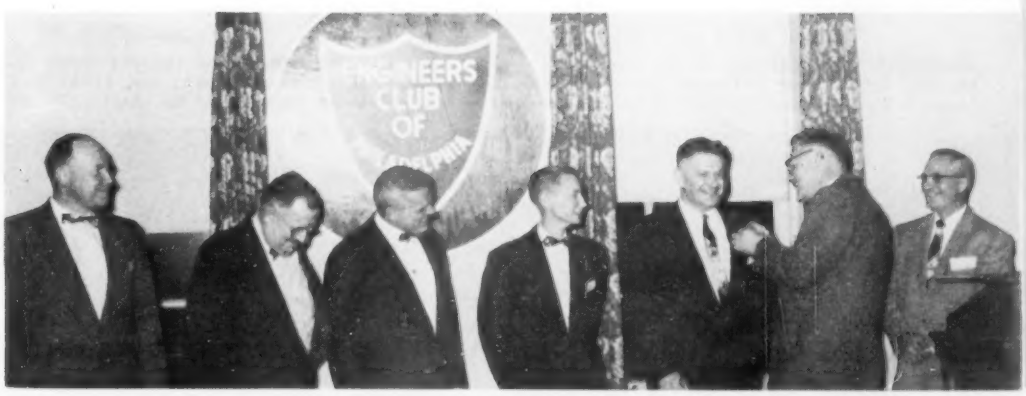
Newly elected officers of Hartford chapter for the coming term of 1956-57, smiling cheerfully at the camera, are, from left: Harry Anderson, first vice chairman; Howard Wheeler, secretary; Henry Gotta, chairman; Douglas Proctor, treasurer; and Paul Dillberg, second vice chairman.



Peoria chapter's new officers, from left, are: seated, Walter Ballard, chairman, and W. M. Williams, delegate. Standing: Leo Johnson, first vice chairman; E. F. Bain, secretary; Charles Tobin, treasurer; and William Bahnfleth, Jr., second vice chairman.



New Portland, Ore., chapter officers are, from left: R. B. Lyons, treasurer; R. C. Erickson, chairman; Prof. M. C. Sheely, first vice chairman; and J. L. Lomnicki, secretary. Not pictured are E. S. Reilly, second vice chairman; D. J. Melody, delegate, and F. L. Allen, alternate.



At the installation of Philadelphia chapter's new officers Richard Gross, 1955-56 chairman (second from right) places the chairman's pin on the lapel of Chairman Edward Wheeler. Watching are, from left: Campbell Pittsinger, secretary; Roy Paulsen, delegate; William Chalfont, second vice chairman; Walter Lees, first vice chairman; and Howard McMillen, 1955-56 national vice president.

new chapter officers

Baltimore chapter elected its new officers at the Feb. 1 meeting. President Harry B. Osborn, Jr., as special guest and technical speaker, offered his congratulations to the successful candidates. They are from left: Leroy Rubright, retiring chairman; G. A. Andrews, treasurer; Alex Wolak, secretary; Jim Rodgers, second vice chairman; A. J. Taormina, first vice chairman; Roy Pyrene, chairman; and Dr. Osborn.





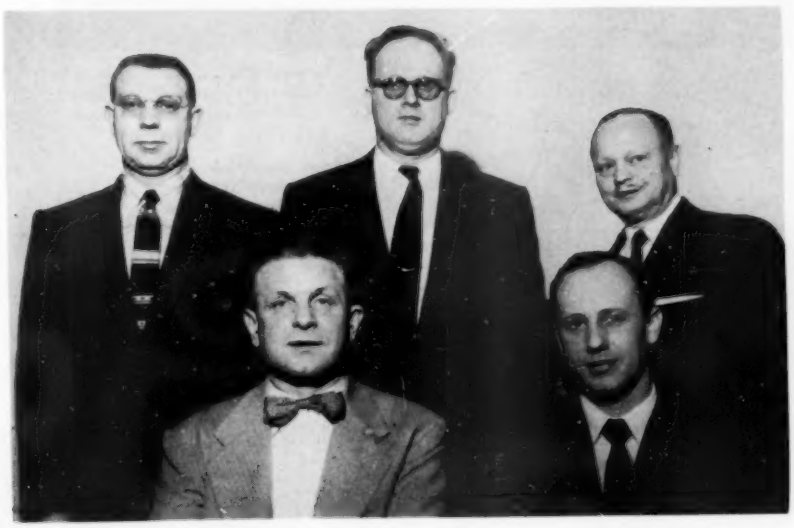
Members of the Elmira chapter elected officers on Feb. 6 at the Mark Twain Hotel. Seated, from left, are: Arthur Green, chairman; and Michael J. Buffalin, first vice chairman and delegate. Standing are: Walter Kieffer, second vice chairman; Karlton Beach, secretary; and Francis Shepherd, alternate. Treasurer Frank Saper was not present for the picture.

Heading the Toledo chapter for the coming year will be, from left: Walter J. Toepfer, national delegate; Lester H. Fox, treasurer; Julian S. Pawlina, secretary; James F. Sullivan, second vice chairman; Philip C. Wood, first vice chairman; and Lewis C. Pascoe, newly elected chairman of the chapter.





The Hobby Ranch House was the scene of the Fort Wayne chapter's Feb. 8 election. New officers are, seated from left: D. A. Chambers, first vice chairman; and E. J. Gildea, Jr., chairman. Standing are: A. E. Peterson, secretary; R. G. Spaw, second vice chairman; and R. H. Bienz, treasurer.



Taking on official duties of the Springfield, Ohio, chapter are, seated from left: Walter Ulane, first vice chairman; and Andrew Reeb, chairman. Standing are: William H. Anderson, second vice chairman; J. Norman Dye, secretary; and Russell Snook, treasurer.



Retiring Chairman Hugh Garrison, front and center, congratulates East Texas chapter's new chairman. From left are: Chairman H. L. La Baume; W. A. Van Blarcom, first vice chairman; Laurence Hoffmann, second vice chairman; J. D. Dillon, secretary; and W. C. Harris, treasurer.

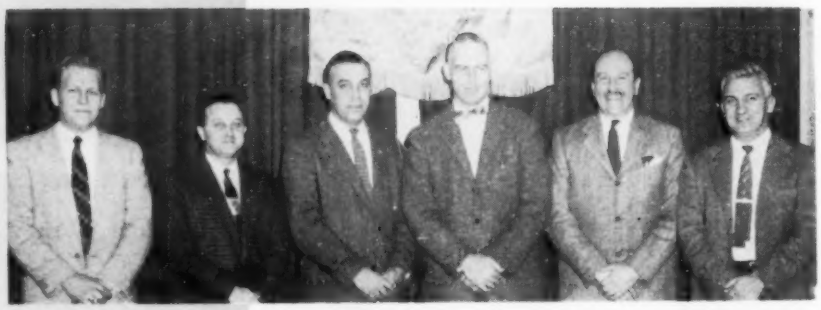


Serving Long Island chapter for the coming year are, seated from left: Jerome Barfus, second vice chairman; John C. Hatter, chairman; Theodore Borecki, first vice chairman; and Don Griffing, secretary. Standing: Sheldon Meyers, treasurer; and George J. McLaughlin, national delegate.

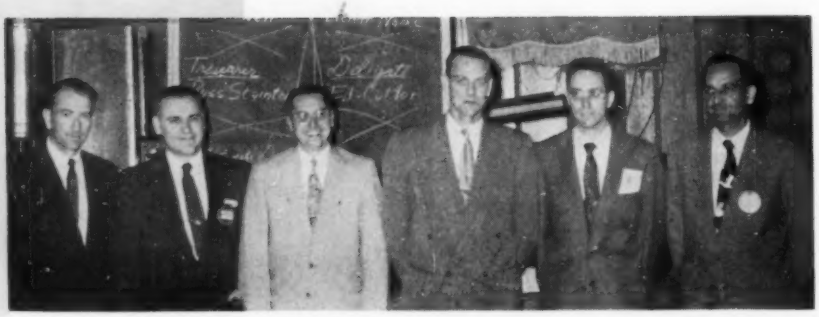


Recently elected Hendrick Hudson officers, from left, are: Treasurer D. Clickner, First Vice Chairman G. Scheffler, Chairman F. Adams, Secretary G. DeRubertis and Second Vice Chairman W. Edminston.

Activities of Monadnock chapter will be directed by: Treasurer Earle C. Quimby, Jr., Secretary George E. Zahos, Delegate Bert M. Dardani, Chairman Richard D. Swahnberg, First Vice Chairman James L. Franciscus, and Second Vice Chairman Raymond H. Carter.



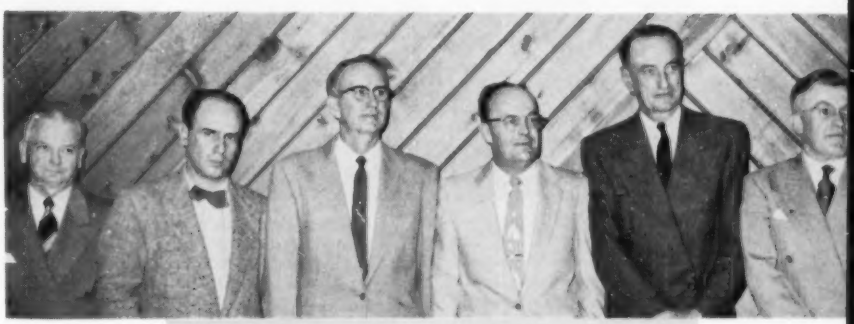
Top posts of San Gabriel Valley chapter are being filled by: Ed Cutler, delegate; Lincoln Mager, chairman; Joe Wajdik, first vice chairman; Alan Howell, second vice chairman; Everett Nance, Secretary; Russ Stainton, treasurer.





Elected to serve Muskegon chapter during 1956-57 were, from left: Gordon Carlisle, treasurer; John L. Jones, secretary; Walter Chaffee, second vice chairman; Leslie R. Nelson, first vice chairman; Verne Nephew, chairman; and John R. Baker, delegate.

Named at the Albuquerque ASTE election were: A. H. Stuart, alternate delegate; Nick Sannella, Jr., delegate; R. M. Frow, treasurer; P. L. Stewart, first vice chairman; H. L. Durflinger, secretary; and H. R. Hanen, chairman. James Felter, not pictured, is second vice chairman.





Officers of Rockford chapter, seated, are: H. W. Lewis, treasurer; Walter Fraser, first vice chairman; J. A. Jannenga, chairman; and Marshall Samuelson, second vice chairman. Standing: E. A. Norrman, third vice chairman; and L. C. Monson, secretary.

At Hamilton District's election these members were voted into office: F. C. Johnson, delegate; R. G. Fechnay, third vice chairman; J. A. Sheldon, chairman; R. I. Hall, second vice chairman; H. B. Ward, first vice chairman; and William Durrant, treasurer. O. McIntyre, not shown, is secretary.



new chapter officers



Guiding Erie chapter activities for the 1956-57 term will be these new officers. Seated, from left, are: H. W. Sedler, first vice chairman; D. B. Schuler, chairman; and Retiring Chairman John August. Standing are: Samuel A. Fiorenzo, second vice chairman; Charles Williams, treasurer; and Richard Banazek, secretary.



Denver chapter's leaders for the coming year are, from left: Norval Allen, delegate; Russ Anderson, treasurer; George Buckel, chairman; Douglas Williams, secretary; Clyde Elliot, first vice chairman; and Robert Farnsworth, second vice chairman.

Retiring North Texas Chairman Don Fish, left, congratulates the newly elected slate of officers who are, from left: F. P. Simpson, chairman; L. D. White, first vice chairman; Ralph Verson, second vice chairman; Lee Edmondson, secretary; and Lou Jaenecke, treasurer.

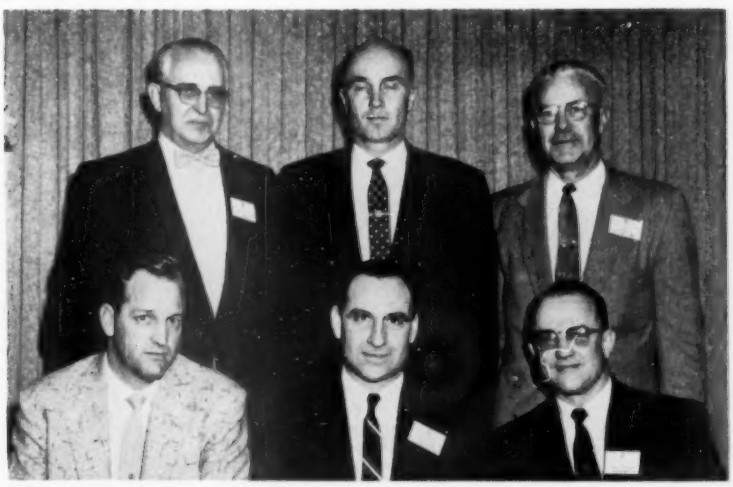


The Antlers' Hotel was the scene of the Indianapolis chapter's election on Feb. 2. The new slate of officers includes, from left, seated: Richard Garber, first vice chairman; John Huser, chairman; and Roy Erickson, second vice chairman. Standing are: Ted Harding, delegate; Murray Davidson, secretary; and Byron Confer, treasurer.





San Fernando Valley chapter's banner serves as a background for the newly elected officers' portrait. Assuming official duties will be, from left: A. T. Rando, chairman; T. E. Tomlinson, secretary; K. H. Griffin, alternate; R. C. Broomell, first vice chairman and delegate; J. R. Bethune, second vice chairman; and C. H. Goodspeed, treasurer.



Members of the Salt Lake City chapter elected their officers at the Ambassador Club on Feb. 10. Heading up activities of the Utah chapter for the coming year will be, from left, seated: J. L. Oviatt, first vice chairman; W. A. Lane, chairman; and W. P. Paxton, second vice chairman. Standing are: W. J. Bullough, immediate past chairman and delegate; Ralph Fugate, secretary; and C. J. Hardy, treasurer.



Activities of Western Reserve chapter will be in the hands of these officers during the coming term: from left, Gene Helfer, chairman; Ed McCabe, first vice chairman; Charles W. Ramsey, third vice chairman; Steve Millik, treasurer; and Ray Beatty, retiring chairman. Not pictured are Gene Boron, second vice chairman, and Karl Stevens, secretary.

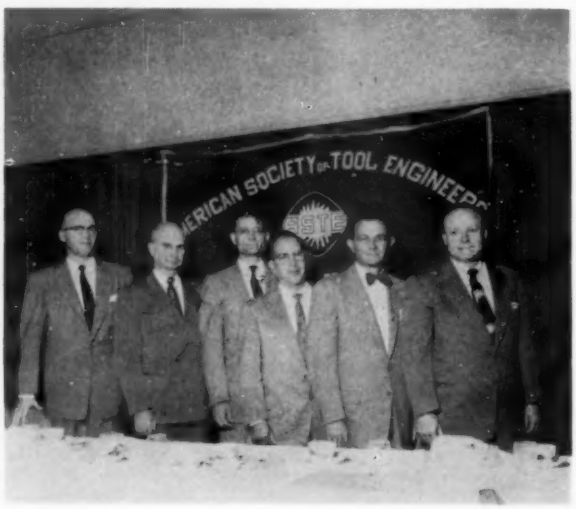


Lehigh Valley chapter officers for 1956-57 will be, from left: seated, Samuel Kuba, first vice chairman; Vincent Scalese, chairman; and George Savitz, second vice chairman. Standing are Paul Gehris, secretary; Ralph Mueller, delegate; and Walter Yarema, treasurer.



New Greater New York chapter officers, elected at their February meeting, are, from left: Hy Frieman, treasurer; Fred Bechtold, second vice chairman; William F. Reber, chairman; Jean Nazeley, first vice chairman; and Robert McFarlane, secretary.

Newly elected officers of Houston chapter, from left, are: Paul Langdale, first vice chairman; S. E. Rees, second vice chairman; J. W. Hindman, Jr., retiring chairman; John Bailleres, chairman; Harry Betts, treasurer; and C. K. Hay, secretary.





Rochester chapter officers for the 1956-57 term are, from left: front row, Sherman Hagberg, executive committee member; Ervin Hodson, third vice chairman; John Lawrence, chairman; Arthur Lang, second vice chairman; Carl Greenman, secretary; and William Kamola, delegate. Back row: Floyd Weed and James Palmer, members of the executive committee; Van Buren Hansford, treasurer; and Clifford Sears, first vice chairman.



Leading Golden Gate chapter's activities for the coming year will be, from left: James Brennan, second vice chairman; Phillip Freeman, first vice chairman; Hans Metz, chairman; Charles Driesbock, secretary; and John Wilson, treasurer.



New officers of Western Michigan chapter are, from left: seated, James R. Wagner, Jr., second vice chairman; William G. Bylsma, chairman; and John S. Pridgeon, first vice chairman. Standing are: George A. Lensky, treasurer; and James J. Rost, secretary.



Top officials of the Oklahoma City chapter include: Bob McVay, secretary; Larry Renth, first vice chairman; Alvin Markwell, second vice chairman; W. B. Haney, chairman; and R. V. Price, treasurer.



Members of the Buffalo-Niagara Frontier chapter voted this group of leaders to serve as ASTE officers for the year 1956-57. From left to right, they are: Raymond C. Klas, treasurer; Robert S. Slate, chairman; J. Robert Fisgus, second vice chairman; Russell W. Fitch, first vice chairman; and Arthur F. Thermahlen, secretary.



Guiding ASTE activities for Riverside chapter are: Chairman Edison A. H. Busher; First Vice Chairman Hugh Foster; Second Vice Chairman S. P. Christoffersen; Secretary Earl Goodwin, Treasurer Charles Lea; Delegate Fred E. Winters, and Alternate Delegate Oral S. Piercey.

Purdue Vice President Frank C. Hockema, Dies

Long a friend of ASTE and widely known to educators and industrialists alike, Dr. Frank C. Hockema, vice president and executive dean of Purdue University, died of a heart attack on Feb. 3. His death marked the end of 35 years of service to the university. Always in great demand as a public speaker, Dr. Hockema addressed the Society's semiannual meeting in 1951.



Dr. Hockema

Having served as assistant professor, associate professor and full professor at Purdue, he conducted many extension classes for factory personnel and management officials in earlier years.

Dr. Hockema had been regional director of the Association of Governing Boards of State Universities and Allied Institutions since 1953, and an industrial consultant since 1925.

Position Wanted

SENIOR MEMBER—of Canadian chapter, age 35, European born, who has been in Canada 5 years, seeks an interesting position in an American company. Succesful background in tooling and production. Present position is superintendent in engineering department. Previously acted as toolroom foreman, tool design supervisor, plant engineer and project engineer. Write to Box 070, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Standards Association Honors George F. Bryan

George F. Bryan, member and past chairman of ASTE's National Standards Committee, was honored recently by the American Standards Association in recognition of his work in the development of American standards. Mr. Bryan represents ASTE on the Standards Council which is responsible for the technical program of the ASA.

His citation read: "The American Standards Association presents this certificate in recognition of contributions to the establishment of voluntary standards and in appreciation of sound advice and devotion of energy to the furtherance of the standards movement as a means of advancing the national economy."

coming ASTE meetings

On-Campus Conferences

STATE UNIVERSITY OF IOWA—April 21, Iowa City, Iowa. Theme: "Automation for Small Industry."

PURDUE UNIVERSITY—April 28, West Layfayette, Ind. Theme: "What is New in Tooling?"

Chapter

BOSTON—April 12, 6:30 p.m., New England Mutual Hall. "Tool Economics" by Henry Sharpe, Brown & Sharpe Mfg. Co. Charter member night.

COLUMBUS—April 11. Speaker, James Lincoln, Lincoln Electric. Technical session, annual executive night.

DAYTON—April 7. Technical program.

DETROIT—April 12. Senior section, plant tour. April 5, carbide section, fabricators night. April 5, Junior Room, Rackham Bldg., carbide section, Gunnary Olsen of Ingersoll Milling Machine Co. will discuss machine and cutter design for best carbide milling operations.

FORT WAYNE—April 11, 6:45 p.m., Hobby Ranch House. "Tracer Lathes" by John Hussey, American Tool Works.

HENDRICK HUDSON—April 18, 6:30 p.m., Circle Inn, Latham. "Fallacies and Facts for Carbide Users" by Eb Weller, manager of tool sales, General Electric Co., Carboloy Div.

LEHIGH VALLEY—April 20, 8 p.m. Plant tour of General Electric Co., Allentown.

LITTLE RHODY—April 5, 6:30 p.m., Johnson's Hummocks. "Automation" by Sulo Aijala, William D. Munro and Robert Merriam, engineers and designers, Spencer-Thermostat Div., General Plate.

LONG ISLAND—April 9, 8:30 p.m., Garden City Hotel. "Chem-milling" by Frank L. Bailey, sales manager, Chem-Mill Div., Turco Products, Inc.

LOS ANGELES—April 12, 7:30 p.m., Tour of Los Angeles police headquarters.

LOUIS JOLIET—April 17. "Simplified Drafting Practice" by W. L. Healy, superintendent, technical service, General Electric Co.

MILWAUKEE—April 12, 6:30 p.m., American-Serbian Memorial Hall. "Atomic Energy, a Bombastic Presentation" by Malcolm F. Judkins, manager, New Products Div., Firth-Sterling, Inc.

MONADNOCK—April 19, 7:15 p.m., Kingsbury Cafeteria. "Professional Engineering in Industry" by George Julien of Jones & Lamson Machine Co. and also regional chairman of ASTE National Professional Engineering Committee; and Wesley Haynes of New Hampshire State board of professional engineers.

NEBRASKA—April 6. "Civilization through Tools," sponsored by The DoAll Co. Joint meeting with ASME and ASQC.

NORTHERN MASSACHUSETTS—April 17, 7 p.m., Athol. "Optical Comparators" by H. L. Murch, Jones & Lamson Machine Co.

NORTHERN NEW JERSEY—April 10. "A New Approach to Broaching" by Detroit Broach Co.

PIEDMONT—April 9, Mecklenburg Hotel. "Gear Hobbing" by S. J. Johnson, chief engineer, Small Tool Div., Barber-Colman Co.

PITTSBURGH—April 6, 6:30 p.m., Gateway Plaza. "Mathematical Approach to Tool Engineering" by Dr. Morris Ostrofsky, advisory mathematician, Westinghouse Research Laboratory.

SAN FERNANDO VALLEY—April 4, Hody's Restaurant, North Hollywood. "Selection and Heat Treatment of Tool Steels" by C. P. McShane, metallurgist, Crucible Steel Co. of America.

SANTA CLARA VALLEY—April 17, Old Plantation Inn, Los Altos. "Die Casting."

SOUTHEASTERN MASSACHUSETTS—April 17, Moose Hall, Attleboro. "Abrasives" by Robert I. Belmont, Bay State Abrasive Products Co.

TOLEDO—April 11, 7 p.m., Maumee Yacht Club. "Wax as a Lubricant for Metalworking" by George L. Boehm, S. C. Johnson & Son, Inc.

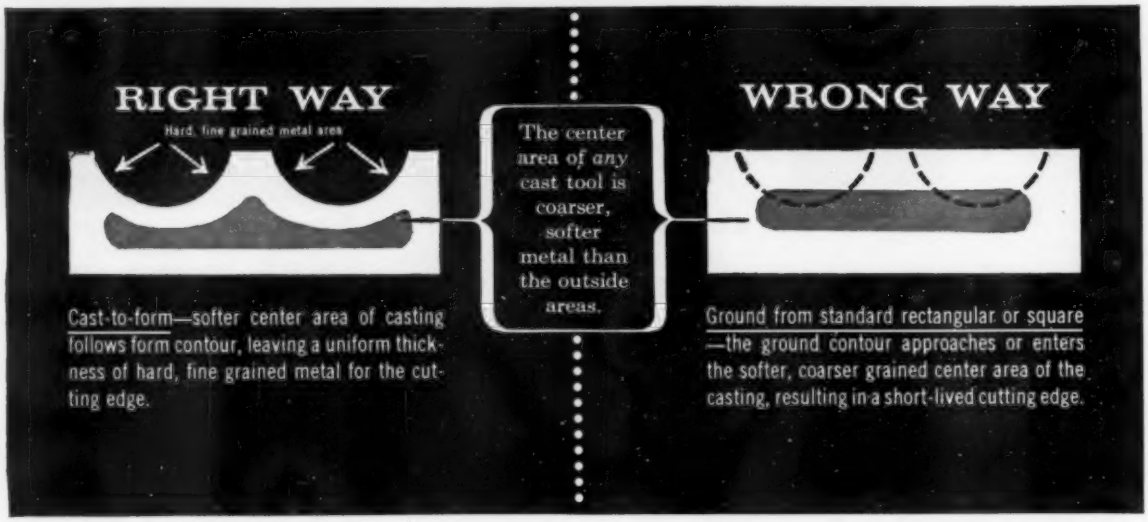
TWIN STATES—April 11, Springfield, Vt. "Statistical Quality Control." Joint ASTE-ASQC meeting.

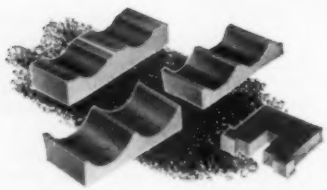
WILLIAMSPORT—April 9, 7 p.m., Williamsport Moose Club. Speaker, Henry Rober, engineering specialist and assistant chief designer, Sylvania Electric Products Co.

WINDSOR—April 6, 7 p.m., Prince Edward Hotel. Ladies' Night.

WORCESTER—April 3, 7 p.m., Putnam & Thurston's. "Ultrasonic Machining of Hard Metals" by G. C. Brown, The Sheffield Corp. April 30, all day. Regional Conference for Tool Engineers.

HOW TO GET LONGER-LASTING, LOWER COST CAST ALLOY FORM TOOLS





TANTUNG IS NOT HIGH SPEED STEEL —

it is an exclusive alloy cast to hardness with no subsequent heat treating!

TANTUNG CUTS FASTER—twice as fast as high speed steel. It bridges the gap between maximum speeds possible with high speed steel and minimum speeds practical with cemented carbides.

TANTUNG CONTAINS CARBIDES—of tungsten, tantalum and columbium. This combination gives it superior toughness and lower friction coefficient than ordinary cast alloys.

TANTUNG HAS HIGH RED HARDNESS—it maintains cutting hardness at red heat temperatures well above that of high speed steel.

TANTUNG IS STRONGER—transverse rupture strength about double that of most cast alloys.

Get the Cost-Cutting Edges from the V-R man. Call your local V-R distributor or representative.

Specify V-R TANTUNG Cast Alloy Preformed to your Prints!

Cast-to-form tools last longer! TANTUNG cutting tool alloys are chill cast in permanent molds to impart fine grain structure, high hardness, and high transverse rupture strength—characteristics which permit very high cutting rates and insure long tool life.

By specifying form tools *cast-to-shape* you retain these desirable characteristics. But, as shown in the drawings above, if you grind the form into standard rectangular or square cutting tools, you will approach or penetrate the coarser grained center area of the casting and destroy the very advantages for which you chose TANTUNG in the first place! (This softer center area is common to *all* cast cutting tools because this is the last point to solidify and is not subject to the chill condition on the outside of the casting.)

Cast-to-form tools cost less! The slightly higher original cost of buying your TANTUNG tools cast-to-form is saved many times over by elimination of form grinding costs, faster cutting, longer tool life with more regrinds possible, and reduced downtime for tool changes.

ASK FOR CATALOG

24-page V-R TANTUNG Catalog gives technical data and lists solid tool bits, tipped tools, cut-off blades and toolholder inserts. Write today or call your V-R Distributor or Representative.



MANUFACTURERS OF CEMENTED CARBIDES AND TANTUNG CAST ALLOYS • TOOLS • BLANKS • TOOLHOLDERS • INSERTS • DIES

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T-564

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PROGRESS IN PRODUCTION

ULTRA PRECISION MEASUREMENT LABORATORY UNVEILED AT SHEFFIELD

The Eli Whitney Metrology Laboratory, equipped to test precision of industrial gages and other measuring devices to an accuracy of a millionth of an inch, has been established by The Sheffield Corp. Primarily the laboratory will make use of the light-wave measuring process known as interferometry under rigidly controlled conditions of temperature, humidity and atmospheric pressure, to provide the precise standard measurement required today.

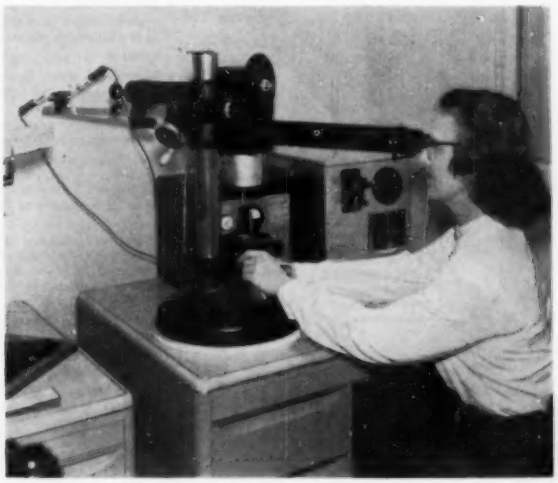
Design of the laboratory was dictated by results of extensive study and research into leading government standards laboratories. As precaution against any shock, the entire floor space of the laboratory is mounted on detached separate footings and is structurally independent of the rest of the building in which it is located. The floor base is composed of two thick layers of concrete separated by a 4-in. layer of insulating cork. The 8-in. walls are heavily insulated to provide protection as a heat reflector and as a vapor barrier. There is a perforated subceiling and 36 in. higher the structural ceiling, insulated with 4-in. cork slab. The window is Thermopane.

In order that there be no minute changes in metal gage block sizes

An electronically amplified comparator is being used to test industrial gage blocks against master gages. Blocks rest on "cooling out" tables to prevent excessive handling which could result in minute errors due to heat variation.



Metrologist in Sheffield's laboratory sets up an interferometer to measure absolute length of a 2-in. master gage block to an accuracy of one-millionth of an inch. Interferometer utilizes light wave standards for measurement.



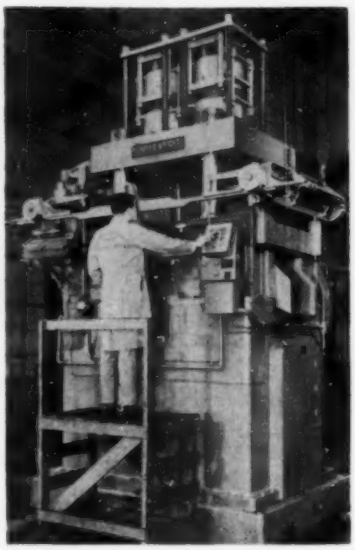
caused by variable room temperatures, temperature controls maintain 68F to an accuracy of ½₀ deg F. Relative humidity is held to less than 50 percent.

Between the structural ceiling and the subceiling of the laboratory, air from various sources is blended, cooled and then heated and cleansed by electrostatic precipitation. The conditioned air then enters the laboratory without drafts, through perforations in the subceiling. Air within the room is changed completely every five minutes.

Within the laboratory is a smaller room housing the master interferometers used in calibrating master reference blocks to light wave accuracy and also contains instruments for accurately measuring barometric pressure. This room has its own separate temperature controls.

Measurement and inspection services provided now by the laboratory include gage block calibration, parts contour measurement, surface finish analysis, plain and taper plug and ring gage calibration, measurement of cylindrically ground parts, calibration of master setting gages, surface plate and parts flatness, thread gages, and thread and gear measurement wires. It also provides equipment for measurement of precision threaded parts, hardness testing, end measure calibration, calibration of precision circles and fiber fineness measurement. Instruments used in the laboratory include apparatus of American, German, English and Swiss origin.

GIANT DIEING UNIT MOVES INTO PRODUCTION



This 400-ton capacity automatic dieing machine, for use with large-sized progressive dies, will be used to produce truck brake parts at speeds ranging from 45 to 90 strokes per minute. It is equipped with air cushions on the upper crosshead, double roll feed, scrap cutter, herringbone gearing, and is driven by a 60-horsepower motor through a variable speed transmission.

The unit, built by Henry & Wright Div. of Emhart Mfg. Co., weighs more than 56 tons—probably the largest such machine ever built.

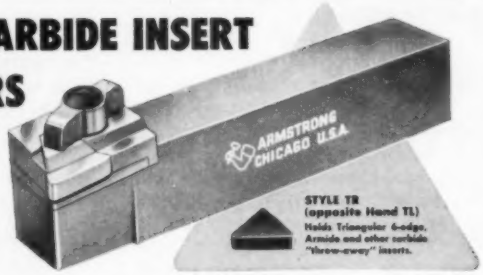
VERTICAL CHUCKER INTRODUCED

Large capacity vertical multiple-spindle hydraulic chucking automatic has been designed by National Acme Co. of Cleveland. Identified as the Acme-Ryder, it is an 8-spindle model equiped with 14-in. capacity chucks, 8 turning slides and 4 cross slides. These cross slides are operated on the vertical turret simultaneously for greater tooling adaptibility in production machining.

Rigidity and permanent toolslide alignment are insured by heavy columns supporting the unusual arch-type construction of the frame. The cross slides are mounted on the lower frame and actuated from cam drums located directly beneath them. This construction gives maximum support for the heaviest forming cuts as well as cross facing or necking operations on the surface of the piece.

Standard spindle speeds of the vertical chucker range from 32 to 628 rpm providing an ample reserve to accom-

New
ARMSTRONG
Armide CARBIDE INSERT
TOOL HOLDERS





Embody...Convenience, Economy Simplicity and Strength based on these superior features:

- IMPROVED CLAMPING METHOD — speeds indexing of Inserts.
- REPLACEABLE SEAT of Hardened Tool Steel — protects shank and provides flat base to prevent damage to inserts as they are clamped in position.
- SHANK of Heat Treated Alloy Steel — gives extra strength and rigidity.

A slight turn of a single screw permits rapid indexing of the ARMIDE insert—reducing down time to a minimum.

The use of ARMIDE "throw away" inserts provides the economy of multiedged inserts—triangular inserts have six, square inserts eight cutting edges. These are available in Utility or Precision finish and in three grades of ARMIDE: 350, 370 or 883.

Protection to the shank is given by the replaceable tool steel seat which prevents wear and damage to the shank and provides a flat base for the insert reducing the possibility of damage to the insert as it is clamped in place. A relief groove is ground into the seat providing clearance when a dulled insert with "built up" edges is turned over.

ARMSTRONG ARMIDE Carbide Insert Tool Holders are furnished in two styles and three sizes. Complete data on these tools is given in Bulletin CIT, mailed on request.

Buy ARMSTRONG TOOLS from your Industrial Distributor

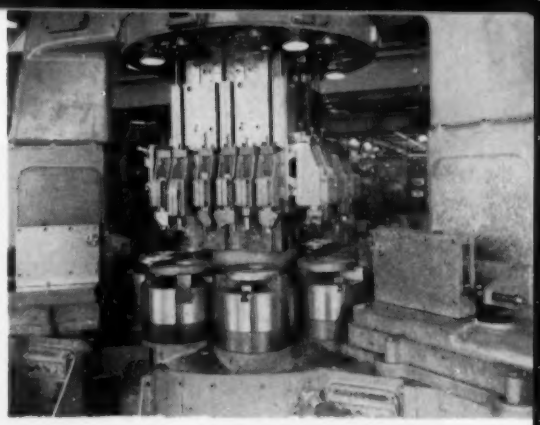
Write for catalog

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5257 W. ARMSTRONG AVENUE CHICAGO 30, ILL.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-164

modate future tooling advancements. Three spindle speeds are available at each spindle position with each set of pick-off gears. An independent indexing motor gives positive indexing of the spindle carrier; locking and clamping at completion of the index is hydraulically operated.

Simply adding a cam on the indexed tapping shaft accomplishes change-over from single to double index.

An electrohydraulic system provides both a convenient means of actuation and control.

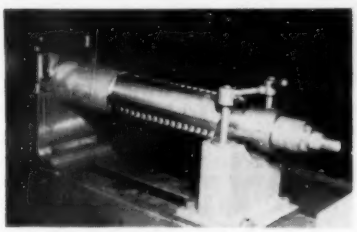


Rear side tooling view of 14-in. 8-spindle vertical hydraulic chucking automatic with double indexing performs 26 operations to complete both ends of cast iron flywheel in a single machining setup. Total machining time is 43 sec.

UNUSUAL PROCESSING TECHNIQUES

Use of a Cyril bath draw forming machine in internal broaching of a 9-ft aluminum tube has been developed by tool research engineers at Chance Vought Aircraft in Dallas, Texas. The problem was to cut down the internal ridges running the length of the long tube 0.0030 to 0.0060 in. The ridges had to be flat on top.

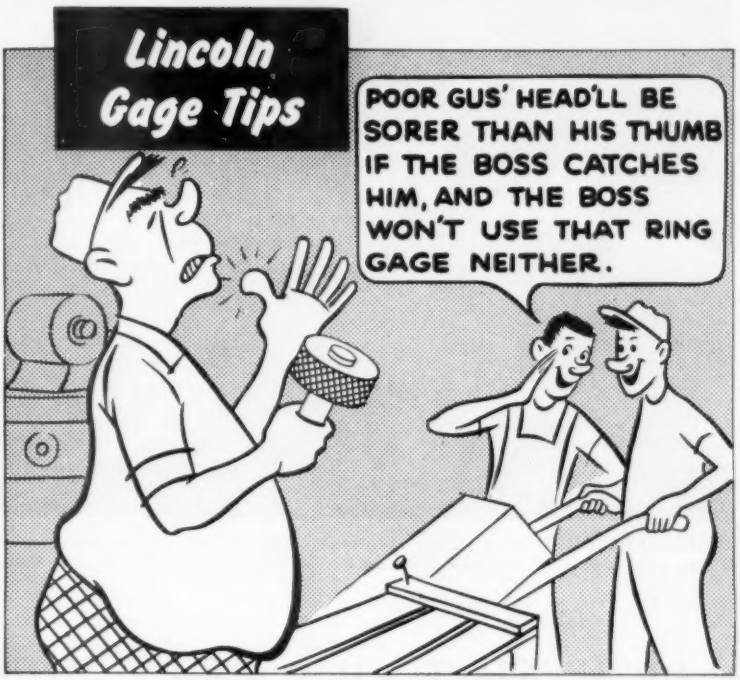
A draw rod about 10 ft long, with a quick disconnect, was attached to a mandrel containing three broaches and three floating wear plates, both adjustable in diameter. This rod was attached



to a 25-ton draw head on the machine. The aluminum tube was clamped in a V-block fixture and tightened to prevent jumping. The broach was pulled through the tube slowly five times to make the desired cut in the ridges.

Recent improvements have also been made in embossing sheet materials. The improvements involve new techniques in producing matched steel embossing rolls and an increase in speeds of the machines. Now, three dimensional patterns, textures, figures and motifs of wide variety are impressed on steel metals, leather, plastics, paper, glass, textiles and other materials, either for decoration, to change texture or impart additional rigidity.

The development is the result of cooperation between the Standard Steel Works Div. of Baldwin-Lima-Hamilton Corp. in supply the rolls and Modern Engraving and Machine Co. in precision methods of engraving.



DON'T TAP or HAMMER WITH A RING GAGE! This type of gage is very delicate and difficult to adjust. A sharp rap could change the adjustment, thus causing false checks.

Thread ring gages should be used only for checking external threaded parts. A ring gage is always adjusted to proper size by means of a master set plug. Before storing a ring gage, make sure all moisture, dirt and metal chips have been removed from threads, then cover the entire gage with a rust preventative and moisture-proof coating.

We, at Lincoln Gage, are forever aware that our customers are depending upon us to supply ultra precision thread and cylindrical gages as specified. We do it . . . a fact that is proven by the steadily growing number of satisfied customers.



Write today for 20 page catalog. Fully illustrates our complete gage line and contains easily read thread standards.



LINCOLN GAGE CO.

23906 HARPER AVE., ST. CLAIR SHORES, MICH.

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Made with MAGNESIUM for better tooling

DOW



LIGHTNESS COUNTS in Checker Cab body assembly. Spot-welding a door pillar is no snap under any conditions, but this fixture made of magnesium plate and extrusions makes it easier at the Checker Cab Plant in Kalamazoo, Michigan.

LIGHTER TOOLS MEAN MORE EFFICIENCY

Lightweight magnesium tooling plate gives jigs and fixtures easier portability . . . reduces worker fatigue

More than ever before, tool engineers are specifying magnesium tooling plate. Ask their reasons and the answers go something like this:

First, of course, there's light weight. Magnesium is one-fourth the weight of steel, one-third lighter than aluminum. The natural result: Work gets done faster, better and with less fatigue. Strained muscles and lost-time accidents show a marked decrease, too. Other reasons always mentioned are magnesium's excellent machinability, weldability, strength and dimensional stability. Prices are low and availability is no problem.

These are the reasons for magnesium's increasing popularity in the tooling field. Take your tooling problems to your nearest supplier of Dow magnesium or write THE DOW CHEMICAL COMPANY, Midland, Mich., Dept. MA 370L.

AVAILABLE FROM STOCK AT: COPPER AND BRASS SALES, INC., Detroit, Mich. • FULLERTON STEEL AND WIRE COMPANY, Chicago, Ill. • HUBBELL METALS, INC., St. Louis, Mo. • A. R. PURDY CO., INC., Lyndhurst, N. J. • RELIANCE STEEL COMPANY, Los Angeles, Calif. • VINSON STEEL & ALUMINUM COMPANY, Dallas, Texas.

you can depend on DOW MAGNESIUM

DOW

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TOOLS of today



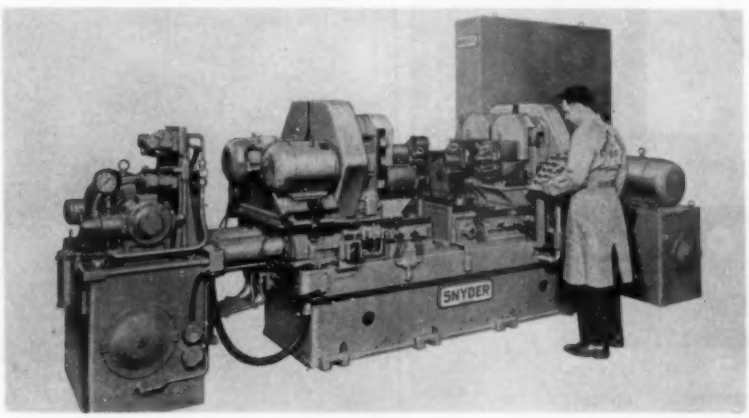
Two-Way Precision Borer

Nineteen different semimass-produced parts with a variety of bore sizes and center distances can be finished on this 8-spindle, 2-way precision boring machine. Two fixtures enable the unit to bore up to 4 holes at each fixture location with the production of a finished part for each cycle of the machine. Each 2-spindle boring head is a separate slide unit and can be operated manually, automatically, individually or in combination with other heads in an automatic machine cycle. A finished part can be produced in an automatic cycle in 50 seconds floor-to-floor time on the electrically operated hydraulically controlled machine.

Special belt-changing devices enable quick spindle speed changes for various bore sizes. Two speeds can be had on the lower spindle of each head and 3 speeds are possible for the upper spindle. Magnetic chucks in the workholding fixtures give maximum workholding flexibility and avoid the necessity of clamping details. Fixture heights are adjusted with quick-change spacers. Gage blocks are provided for adjusting the various parts to correct lateral location. Micrometer steps provide depth control for each head. The boring heads have index pins that enable quick adjustment of hole center line angular location. Center distance of spindles is adjusted with spacers.

Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich.

T-4-1671



Gear Hobber, Shaver

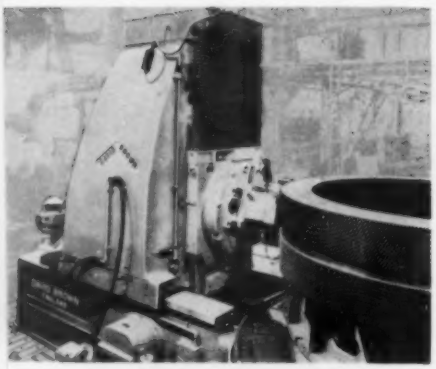
A range of new dual-purpose machines, capable both of hobbing and shaving large turbine gears, is being made by David Brown Industries Ltd. of England. The range of combined turbine gear hobbers and shavers includes machines capable of producing turbine gears from 60 to 175 in. in diam, and pinions and first reduction wheels from 6 to 60 in. in diam.

For shaving, a special attachment is bolted on the hob swivel slide to replace the hob. It is centrally located.

Swivelling of the cutter to the crossed-axis angle required is achieved by power or by hand.

A brake, of the shoe type, fitted to the cutter spindle, enables the tangential load method of shaving to be used. Brake load is adjustable and the amount of torque on the cutter spindle is registered on a calibrated scale.

Four versions of the combined ma-



chine have been developed: the David Brown P60S, MH100S, MH150S and MH175S. The numeral is each case indicates the maximum diameter, in inches, of the gear which the machine can accommodate. All machines are basically similar.

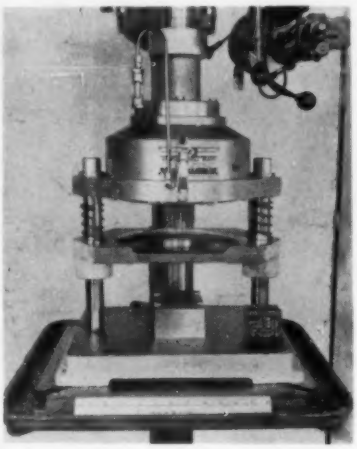
Represented in U. S. A. by Morey Machinery Co., Inc., 383 Lafayette St., New York 3, N. Y. T-4-35

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Gearless Drill Head

A new series of simplified gearless drill heads has been specially designed for drilling printed circuit cards. With these drill heads it is easy to change hole patterns to be drilled.

The hole pattern of the printed cir-



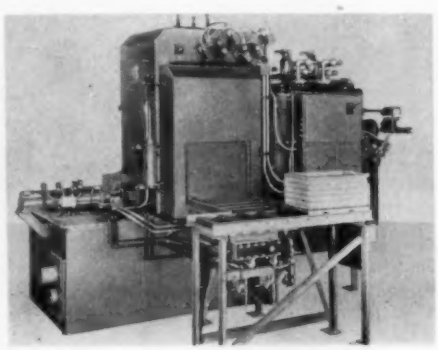
cuit is drilled simultaneously in three Formica plate guides. The user can remove the Formica plates, store for future use and replace with new hole patterns as required.

Holes as close as 0.140 in. between spindles can be drilled, while a rectangular pattern up to 6 x 14 in. is the capacity range. These heads are designed for limited runs.

Zagar Tool, Inc., 23890 Lakeland Blvd., Cleveland 23, Ohio. T-4-36

Batch Type Furnace

An automatic, controlled-asmosphere batch type furnace, the Dowmatic HC-800, preconditions, loads and unloads the work chamber, and quenches the processed charge without operator handling or loss of process time. The operator merely rolls away the proc-



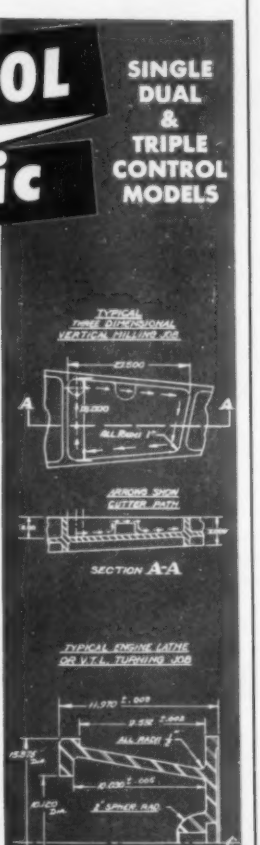
TRACER CONTROL duplimatic

SINGLE DUAL & TRIPLE CONTROL MODELS

Controls standard machine tools for contour machining no other tracer device can perform

When connected the Tracer Control Duplimatic does not interfere with conventional use of the machine tool. Push a button to disengage. Push another to re-engage.





Write for catalog.

TRACER CONTROL CO.
Manufacturers of Duplimatic
595 E. Ten Mile Rd., Hazel Park, Mich.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-168

essed load and places a green charge before the furnace door.

Features of the unit are pressurized operation, double elevator and automatic transfer mechanisms.

The HC-800 has a gross heating rate of 800 lb per hour, temperature range of 1450-1700 F, and an oil quenching system (70-190 F) for carburizing, carbonitriding, carbon restoration and clean hardening.

Dow Furnace Co., 12045 Woodbine Ave., Detroit 19, Mich. **T-4-1691**

Counterbores

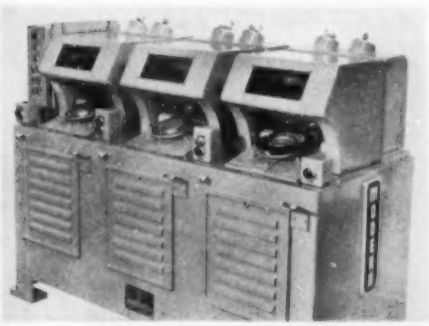
This rigid one-piece tool will counterbore both for the leader pinhead and also the mating shoulder bushing head. Two preground high-speed cutters and the pilot diameters in effect provide two counterbores in one. Positive acting adjusting screws allow fast, easy setting of the cutting edges. The tool may be easily miked to give desired counterbore diameter with a single setting.

Made of chrome-vanadium steel, heat treated and precision ground to close tolerances, it is available in a range of 5 sizes for nominal size pin and bushing diameters from ¾ to ½ in.

Detroit Mold Engineering Co., 6686 E. McNichols Rd., Detroit 12, Mich. **T-4-1692**

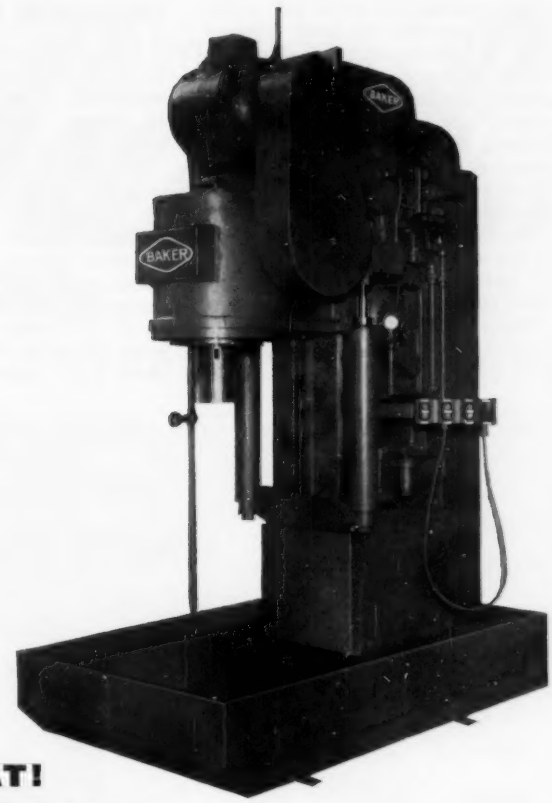
Three-Station Grinder

Deburring and chamfering both the inside and outside edges of hypoid gear teeth may be done with this 3-station grinding machine. Three ring gears are



chamfered at a time, giving a production rate of 300 per hour. One operator easily handles all three stations.

Two air-driven spindles mounting small grinding wheels for the deburring and chamfering operation are located at each work station. Balanced spindles are infinitely adjustable so that the grinding wheel may be set in proper



WHAT!
AUTOMATE
WITH STANDARD MACHINES?

It's true that on low-production jobs a specially built automatic machine tool can take too long to pay for itself. But not so with Baker Basic machines. They cost much less than a machine designed for only one part. What's more, they don't have to be completely "rebuilt" when you have to change your product or production methods. They can be retooled with relative ease and at less expense. Yet you still have full labor-saving automation with loading and unloading devices and conveyors. We'll furnish this equipment as well as tooling if you wish. Use Baker Basics singly or in battery . . . for drilling, boring, facing and other machining operations. In 5 sizes.

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relation to the gear teeth. One grinding wheel chamfers the inside diameter while the other simultaneously chamfers the outside diameter. A chamfer is ground all around the tooth form, including the root and toe, with the grinding wheel actually being cammed around the tooth form by the rotation of the workpiece and the fact that the spindles are counterbalanced.

Various sizes of parts can be handled on this machine and, by adjustments in the tooling, a variety of straight and spiral bevel gears can be chamfered.

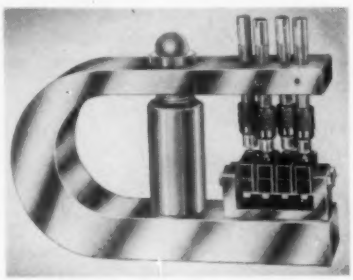
Modern Industrial Engineering Co., 14230 Birwood Ave., Detroit 38, Mich. **T-4-1701**

Mechanical Force Gage

A device for controlling mechanical forces at various load points, the Dillon multiswitch force gage is available in 11 different capacities with from 1 to 4 control switches.

To the lower leg of a U-shaped alloy steel beam is mounted a yoke in which the switches are set. When load is applied across the center of the beam, it deflects inwardly causing adjustment screws in the upper half of the bar to contact the switches. Each switch can be set to function at a different load point within the range of the instrument or all switches can be made to function at the same load. The screws can be permanently set and sealed at the factory or are adjustable.

The gage can be clamped to working surfaces or bolted in place. Accidental overload passes through a solid steel



rod instead of the instrument and cannot injure it or the switches.

Available capacities are: 0-10, 25, 50, 100, 250, 500, 1000, 2500, 5000, 10,000 or 50,000 lb.

Dimensions vary between 4¼ x 1 x 2⅝ in. for the 0-10-lb model to 6¼ x 2⅜ x 4½ in. for the 0-50,000-lb model.

The instrument shown is for compressive use, but tensile models also are available.

W. C. Dillon & Co., Inc., 14620 Keswick St., Van Nuys, Calif. **T-4-1702**



HEAVY-DUTY INDEX TABLES

They're Designed for Heavy-Duty Work.

Their rugged precision construction makes them ideal for inspection, milling, drilling, or assembly operations where accurate single or double spacing is necessary.

Sesco Tables Always Index Accurately.

You can depend upon them for amazingly accurate indexing. A center hole is provided for piloting fixtures on the table, which assures concentricity. Parallelism is to either commercial or precision tolerances.

Top Plate Rotates Freely and Easily.

The tables are operated manually and rotate on a hardened ball race. Over-all height of Sesco tables is held to a height which is advantageous for industry.

A Complete Line to Serve Your Needs.

Sesco tables range in diameter from 18" to 48" and are available with either single or double shot pin. All shot pins are spring loaded. On double shot pin tables a simple locking mechanism is provided to keep one of the shot pins disengaged while working on the other—making it impossible to index the wrong pattern.

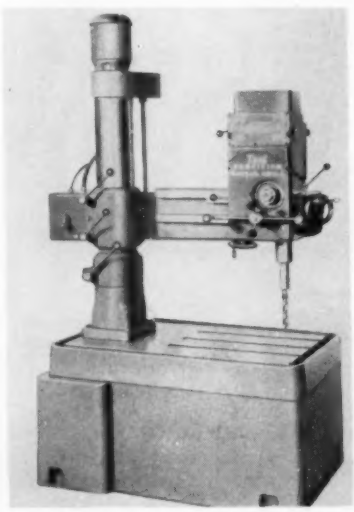
Sesco INC. 8881 Central Detroit 4, Mich. | engineers & manufacturers of machine tools and press room equipment

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-170

Radial Drill

A low-cost precision radial drill features a flame-hardened column for lasting accuracy. Its radial-operated large table, 28½ x 48 in., is provided with ¾-in. T-slots. The sturdy column assures accuracy and freedom from vibration.

All movements are controlled by



positive acting, conveniently grouped handles, dial and wheels mounted on the transmission unit within easy reach of the operator.

There are 16 geared speeds ranging from 50 to 1400 rpm, with hardened easy-mesh gears mounted on hardened and ground spline shafts so grouped that any gear speed can be selected at will with the hand levers.

The 4 lever-controlled power feeds provide the correct feed for the speed and size of drill.

Veet Industries, 25753 Groesbeck Hwy, East Detroit, Mich. **T-4-1711**

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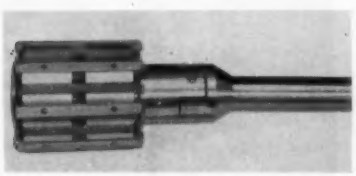
Tube, Bar Straightener

This unit for straightening small diameter tubes and bars in steel, stainless, aluminum, brass, inconel and other metals, features a Syncro-drive which automatically centers materials in pass line without use of guides. Five rolls are incorporated in the unit; all driven by a single motor and angularly adjustable. Roll speeds are coordinated automatically. Each size machine in the line handles a broad range of sizes. Model 000 SD, for example, handles metal 1/16 to 3/8 in. OD.

Sutton Engineering Co., First National Bank Bldg., Pittsburgh 22, Pa. **T-4-1712**

Honing Tools, Abrasives

A line of high-production honing tools features slotted body design that provides good support for the stones. The new Plas-T-Clad abrasive stones are supported on the sides, near the

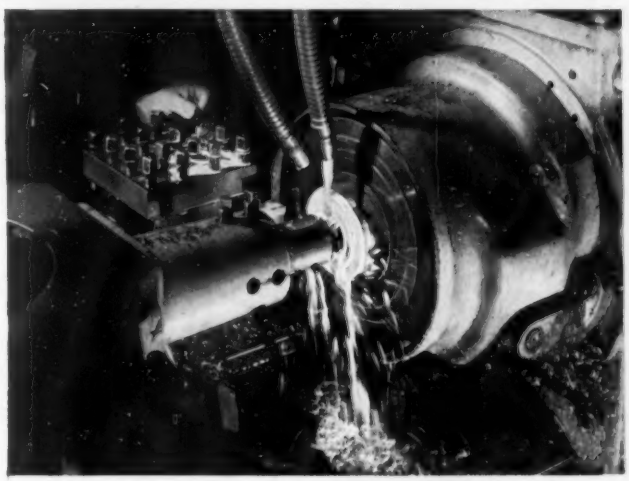


cutting face, by the tool body. Use of a high percentage of the full depth of the honing stone is possible with this design, where the side support is stationary and the expansion support moves as the stone is expended. Protective material covers the sides of the stone to prevent spalling.

With this tool design, the set of ex-

Improved Lusol..

A BETTER PRODUCTION METHOD



Improved Lusol, an oil-free transparent water-soluble metalworking solution, has the highest heat removing capacity of all coolants, regardless of type. It keeps tools cooler so cutting edges last longer. It keeps work pieces cooler so closer tolerances can be maintained. In addition, the Lusol method keeps machines clean, eliminates odors, smoke and oily floors, and eliminates the basic causes of dermatitis. It all adds up to better production under better working conditions. That is worth investigating.

CONCENTRATION TEST KIT

With this pocket size Concentration Test Kit Lusol users can check the concentration of the solution right at the machine. Only takes a minute or two.



THE Lusol.. LINE

BETTER PRODUCTS FOR BETTER METALWORKING

F. E. ANDERSON OIL COMPANY INC.

PORTLAND CONNECTICUT

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pended stones is removed and new stones are inserted in a matter of seconds.

Model HF-8, illustrated, is used for honing medium and large-sized bores. Model HS-5 is used for small to medium bores.

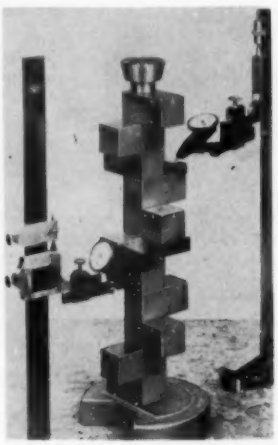
Barnes Drill Co., 870 Chestnut St., Rockford, Ill. **T-4-1721**

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Precision Gage

The Inchmaster is designed to retain a given measurement with a combination of blocks for later checking even though one or more other measurements have to be set up and used before the earlier combination is used again.

Designed to facilitate use of precision gage blocks as well as increase their versatility, the Inchmaster is nontopple, portable, lightweight unit with no moving parts. It is constructed of a stack of individual gage blocks, so arranged that portions of both the upper and lower surfaces of each block are exposed for quick, easy setup. The blocks are of one-inch thickness so that the full inches are directly available on the instrument. Intermediate sizes are



made up of standard gage blocks and placed upon and/or below the proper unit block to obtain the required dimension. Any combination of blocks within the range of the gage is perfectly safe.

Orion Tool Co., 14560 Lesure, Detroit 27, Mich. **T-4-1722**

How TAYLOR * LIQUID SPRINGS for DIES

*TRADEMARK

ACTUAL SIZE



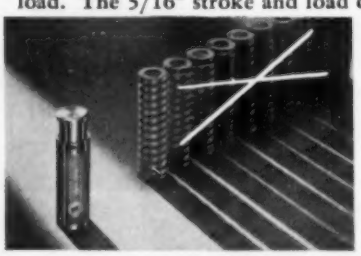
EQUAL 10 HEAVY DUTY DIE SPRINGS OF SAME DIAMETER, LENGTH and STROKE

- SIMPLIFY DIE DESIGN
- CUT COSTS OF DIE MAKING
- PROVIDES AMPLE SPRING PRESSURE TO MAKE COMPOUND DIES

by use of liquid compressibility

PATENTS APPLIED FOR

This revolutionary Taylor 3/4" diameter Liquid Spring is only 2½" long plus threaded stud and delivers 2000 lbs. end load with a 400 lbs. preload. The 5/16" stroke and load can be varied to meet requirements by changing volumes or "Liquipress"* compressible liquids.



Reduces by 900% the time of drilling and tapping holes in dies and "down time" servicing. Pay for themselves in lower installation costs. Taylor Liquid Springs are completely self-contained eliminating stripper bolts and washers.

Write for Complete Line Catalog LS Today

TAYLOR DEVICES INC.

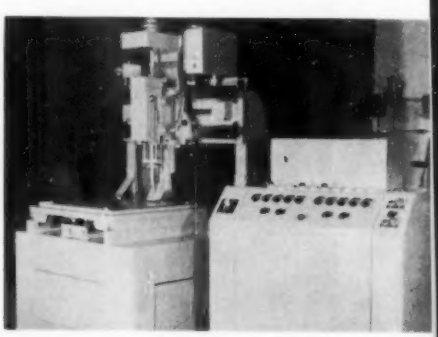
188 Main Street, North Tonawanda, N. Y.

Specializing in the Manufacture of Compressible Material Devices

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-172

Locating and Drilling Unit

Direct numerical input controls the heavy-duty Model LD-24 automatic locating and drilling machine for work up to 24 in. in width and any reason-



able length. The 1-hp automatic drill head will drill up to ½ in. or larger holes. Hole positions are quickly and automatically located.

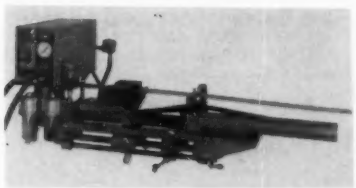
The operator sets actual length and width dimensions in increments of 0.001 in. on direct numerical dials and

presses direction controls to set the machine in motion. Drill unit and table motions are completely automatic. As soon as the selected position is located, the drill feed is automatically actuated. If desired, the drilling operation can be controlled manually.

Even greater savings on short-run operations are possible if the equipment is controlled by the Hillyer multiple-channel programmer. Using permanent, grease-proof, vinyl tape, previously prepared by engineering or set-up personnel, the operator merely loads and unloads. All required machine functions are signalled and controlled by the tape.

Hillyer Instrument Co., Inc., 54 Lafayette St., New York 13, N. Y. **T-4-1731**

Power Press Feed



A Micro-Air power press feed is equipped with centrally located controls with a red warning light on the panel to indicate when the current is on. Rated speed of the carriage is 1½ ft per sec at 100 psi. Feed length may be adjusted while the machine is in operation. Spring loaded grease cups on long bushings permit unusually smooth performance.

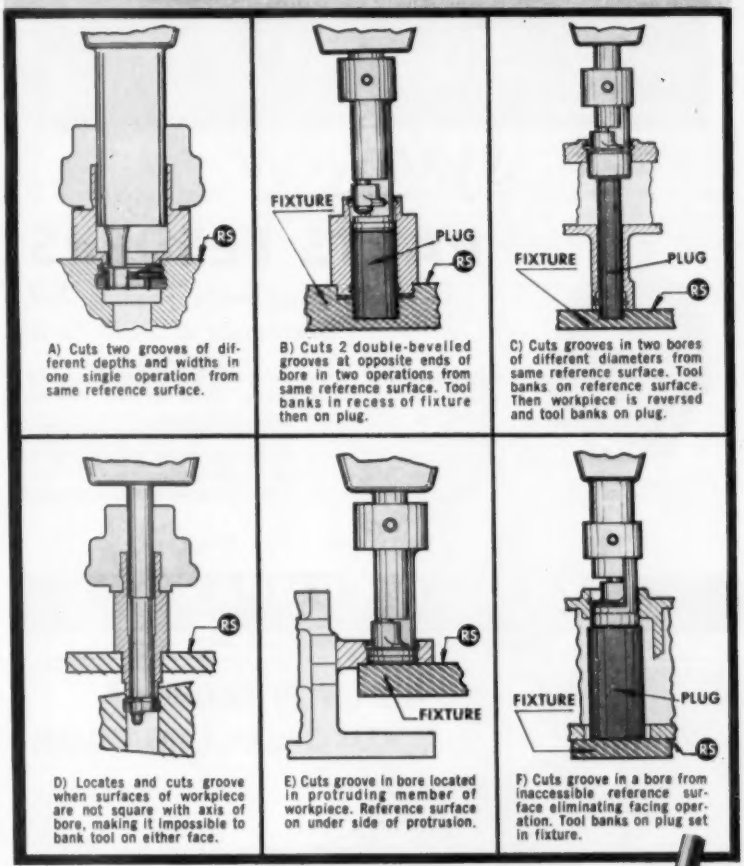
Nadel Tool & Mfg. Co., Inc., 20 Warren St., New York 7, N. Y. **T-4-1732**

Facing Machine

Flat and square surfaces are produced on any workpiece with this new facing machine which has a 14-in. cup-shaped grinding wheel mounted perpendicularly to the table. Workpieces need only one flat surface to be held to the table. Operating at 1400 rpm, the grinding wheel faces cold or hot-rolled steel, tool steels, steel castings and all nonferrous alloys.

When greater stock removal is required, one of two progressive-cutting face mills may be substituted for the grinding wheel. A 6-in. diam, 12-blade milling cutter is used for ferrous alloys, and will remove up to ¼ in. of stock in a single pass. A 12-in. diam, 18-blade cutter is used for nonferrous metals and will make a ⅜-in. cut in one pass. Special gripping fixtures for

Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



A) Cuts two grooves of different depths and widths in one single operation from same reference surface.

B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.

C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks on reference surface. Then workpiece is reversed and tool banks on plug.

D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.

E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.

F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.



Amazingly versatile! Your toughest recess cutting problems can be met simply and efficiently with the Waldes Truarc Grooving Tool because it offers a whole range of possibilities beyond the range of ordinary recessing tools.

Wide Cutting Range! The Waldes Truarc Grooving Tool comes in 5 models...enabling you to cut accurate grooves in housings with diameters from .250 to 5.00 inches.

Send Your Problems to Waldes! Send us your blueprints...let Waldes Truarc Engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job. There is no obligation!

Write NOW for a 20-page manual containing full information on Waldes Truarc Grooving Tool

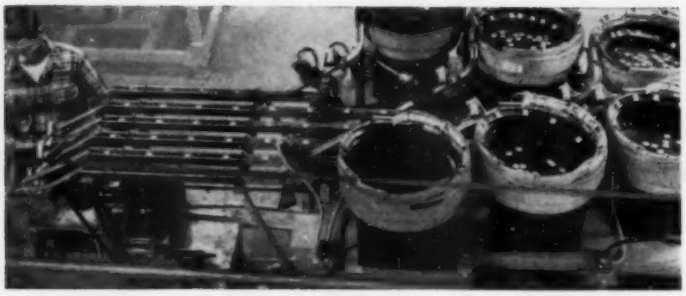


WALDES
TRUARC®
GROOVING TOOL

Made by the Manufacturers of Waldes Truarc Retaining Rings
WALDES KOHINOOR, INC., 47-16 Austel Place, L. I. C. 1, N. Y.
Waldes Truarc Grooving Tool Manufactured Under U. S. Pat. 2,411,426

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Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool. (GT-2-53)
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SYNTRON

PARTS FEEDERS

Provide Automatic Feeding And Orientation of Small Parts



May be set up in single or multiple units.

In testing and sorting processes as well as for assembly, SYNTRON Vibrating Parts Feeders reduce handling costs and increase production. Parts are fed single file—in oriented position—or may be deposited by gravity fed track to dies, indexing tables, etc.—at exactly the right speed. Electro-magnetic operation—no mechanical, wearing parts—no installation problem.

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SYNTRON COMPANY
340 Lexington Ave. Homer City, Pa.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-174-1

A New Principle of
AUTO-COLLIMATION



THE DAVIDSON MODEL D-600

COMPARISON AUTOCOLLIMATOR

This new type angle-comparator permits accurate and repeat measurement of the difference in angle of the returning beams to 1/10th second of arc.

It allows comparison and measurement of small angles to a precision heretofore considered impossible.

Patented design, employs a unique arrangement of optical tipping plates coupled to a calibrated micrometer dial.

Any change in position of the D-600 moves the compared images in the field of view but has absolutely no effect on the micrometer reading.

We gladly discuss optical measuring problems.

DAVIDSON MANUFACTURING CO.
2223 RAMONA BLVD., WEST COVINA, CALIF., U.S.A.
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One of America's Finest Optical Plants

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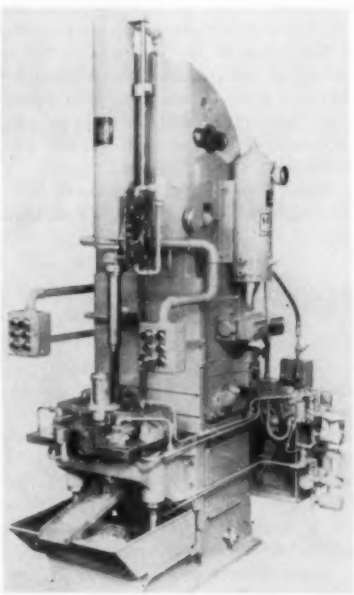
holding nonferrous plate, and magnetic chucks for holding thin ferrous pieces are also available.

Eastown Tool & Engineering Co., 23672 Schoenherr Rd., East Detroit, Mich. **T-2-1741**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hydraulic Press

Thirty external involute gear teeth on the OD of a bronze automotive synchronizer ring are broached by a hydraulic Horning type press with continuous automatic cycle.



Broaches for this machine are mounted in a stationary broach pot, through which the part is pushed. Ten American HSS 30 involute spline broach rings are mounted in the pot

which also acts as a guide for the push bar during the broaching stroke. Parts are fed by a gravity tube feed. A single spline inside the tube radially locates the notched parts.

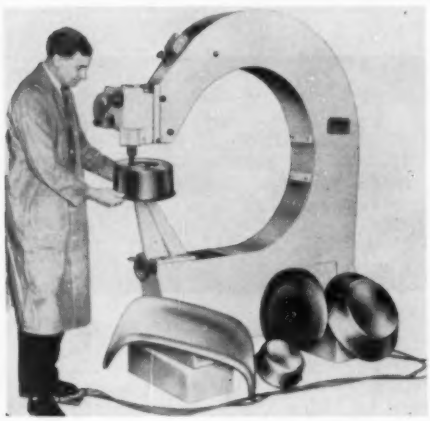
With the machine running on continuous automatic cycle, the operator only has to keep the feed magazine filled with parts.

At a theoretical 100 percent efficiency, production is about 300 parts per hour.

American Broach & Machine Co., Ann Arbor, Mich. **T-4-1751**

Trimmer

A sturdy trimmer, designed for versatility, has a pneumatically operated head that can be raised 2 in. to permit insertion of bulky material quickly and easily. Raising and lowering of the



head to engage and disengage the cutting tools may be done by a remote foot pedal.

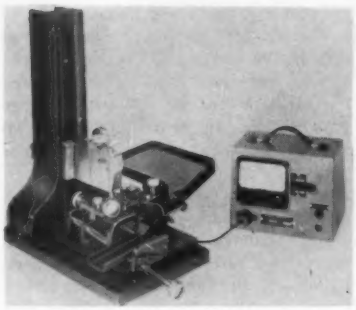
Guide bars on the unit can be detached when edge trimming a large stamping, center cutting a deep drawn stamping, etc. The guide bars can be left on when shaping a large piece of metal.

American Pullmax Co., Inc., 2455 N. Sheffield Ave., Chicago 14, Ill. **T-4-1752**

Ball-Bearing Gage

An attachment for use with Micro-Ac comparators gages ball bearings of from 1 mm up to 1½ in. diam to an accuracy of ½ millionth of an inch. The equipment also can be used for random sphericity gaging.

Essentially, the attachment is a V-shaped block mounted at a slight angle to permit the ball to roll into a chute after completion of the gaging operation. A manually operated lever moves the ball into the gaging position under the Micro-Ac gage head. The gage



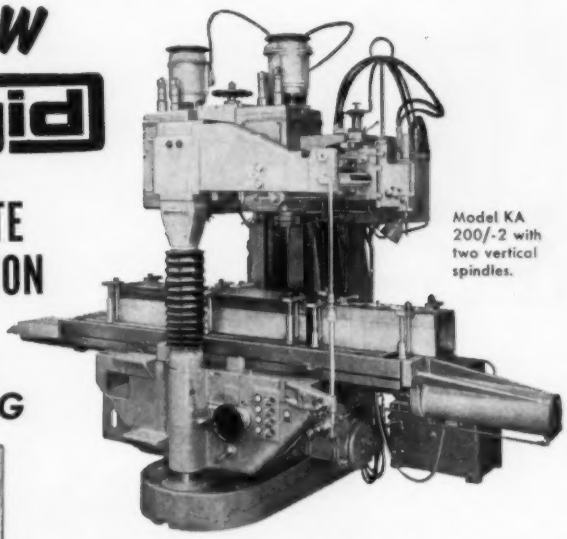
head contact tip pressure is only 4 ounces to prevent work distortion. There is provision for fine adjustment of the head, and a positive stop gives over-travel protection.

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland, Ohio. **T-4-1753**

Punches and Die Buttons for Fasteners

A five-station progressive die, using standard RB punches and die buttons, produces in sheet metal the means for utilizing three different fastening methods: types A & B sheet metal screws, Simmons type spring-lock fastener and

The NEW Rigid provides COMPLETE AUTOMATION in DIE SINKING



Model KA 200/-2 with two vertical spindles.



Turbine blade forging die.



Aluminum compressor wheel 14" in diameter.

Greater Accuracy and Higher Finish Speed Up Production, Reduce Bench Time

The new RIGID die sinking and copy milling machines are hydraulically operated and *fully automatic*. RESULT—greater production speed, less operational supervision. And the high finish produced by these Swiss-made machines reduces time-consuming hand work to an absolute minimum.

The surface travel of the cutter remains constant regardless of variation in contour. Even vertical copying can be performed easily. RIGID Die Sinkers will maintain a normal working accuracy of ±.002" from master to workpiece. Closer tolerances are also possible.

Six models provide a choice of one to six spindles. Optional equipment includes a 360° plus depth profiling head with working accuracy of ±.001" and a Reverse Image attachment to produce left and right parts from one master.

Interested? Write for bulletin.

COSA — *nationwide sales and service of precision machine tools—from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

IN CANADA contact COSA CORPORATION OF CANADA LTD., 40 Front Street W., Toronto

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-175



round clinch nuts, see photo.

For A & B types of sheet metal screws, the punch and die button units pierce, lance and draw a conical shape in the metal in one operation. These punches and die buttons can be used as a part of any die in conventional presses.

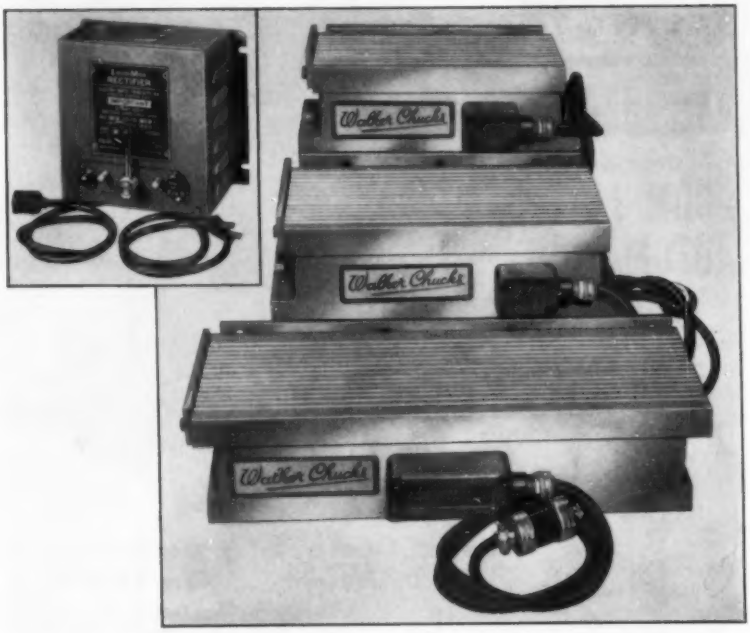
Individual punches and die buttons can be manufactured to specifications to meet hole requirements of any Simmons type fastener design. Standard RB clinch nut punch and die button sets pierce the metal and clinch the nut with one stroke of the press. RB clinch nut tooling, using conventional die construction, can pierce, form or blank the product with the same die.

Richard Brothers Punch Div. of Allied Products Corp., 26500 Capitol Ave., Detroit 39, Mich. **T-4-1761**

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Walker Chucks

You May As Well Have the Best



Walker Longitudinal Bar Pole Chucks . . . three popular sizes . . . low wattage, low price, maximum holding.

5" x 10"	$ 78.00
6" x 12"	$110.00
6" x 18"	$185.00

KD Rectifier with built-in switch to operate from any AC line $43.00

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-176

Milling Calculator

Dual-purpose milling calculator permits rapid calculation of technical operating data. One side, designated Milling Setup, is used to determine spindle speeds and feed rates adequate for toolroom operations, job-lot milling or short production runs. With the



other side, designated Economic Cutting Speed, operator can determine modified cutting speed to give minimum cost per piece for high-production milling jobs. Made of plastic, the calculator measures about 5 x 8 in. Company is not set up to process orders for small amounts.

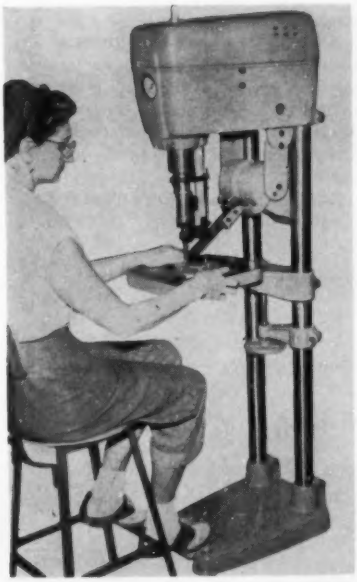
The Cincinnati Milling Machine Co., Cincinnati 9, Ohio. **T-4-1762**

Power Screwdriver

The Model 400 power screwdriver can be operator-controlled for certain work, and then converted to fully automatic operation when required. It will drive as many as 60 screws per minute.

In an automatic operation, this tool is able to feed, guide, control the length of the stroke and automatically maintain a predetermined torque. Several of these machines can be set up to do multiple fastening jobs with only one operator controlling the entire battery.

Where individual piecework is required, the machine eliminates need for individual screw handling, and protects the product from assembly damage. Workpieces can be handled quickly and placed accurately because unit operates

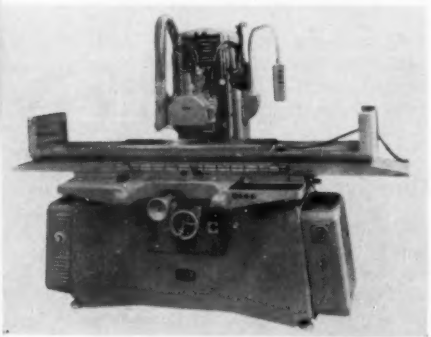


with foot treadle. The tool's driving unit is detachable, for use where space is limited or where center distance between screws is close.

Shakeproof Div., Illinois Tool Works, Power Screw Driver Dept., 2501 N. Keeler Ave., Chicago 39, Ill. **T-4-1771**

Surface Grinders

Adjustment accuracy to 0.00004 in. is a prime feature of the Blohm hydraulic surface grinder. Microtip infeed and depth-feed control on these large-capacity grinders gives automatic push-button depth feed of 0.00004 in.



and cross feed of 0.0002 in., after a rough hand adjustment.

The Blohm Model HFS-12 (illustrated) has a grinding capacity of 14 in. wide by 48 in. long, while four other models range in capacity from 14 x 18 in., to 18 in. wide x 40 in. long. Each model has a 5-hp, 2-speed motor



Ahead Where?

You will see more and more of VULCAN Tool Steels in the near future. They are coming closer through VULCAN's "forward motion," including expanded district office and warehouse outlets.

Thus you will gain access to the special advantages VULCAN Tool Steels offer—to help you produce your finest tools and dies.

VULCAN offers only the finest tool steels—*forged* to assure highest quality.

VULCAN's moderate size and specialization give you close attention to your exact needs. Service is efficient and prompt.

VULCAN Tool Steels are available in all types, shapes and sizes. See your VULCAN representative, or write for VULCAN Tool Steel Data.

Vulcan Crucible Steel Co. Division

HKP

H. K. PORTER COMPANY, INC.
Aliquippa, Pennsylvania
Offices in Pittsburgh, New York, Cambridge, Baltimore, Birmingham, Detroit, Lansing, Chicago, Milwaukee, St. Louis.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-177

mounted directly on the spindle, Oilmatic type adjustable tapered bearings in the spindle. Wheels up to 4 in. wide can be used in conjunction with a cross feed up to 2½ in. per stroke for greater production and efficiency at lower cost.

Various models can be furnished with a Finimatic device to give automatic grinding, the machine stopping itself after three idle runs.

Distributed by Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y. **T-4-1781**

Instruments

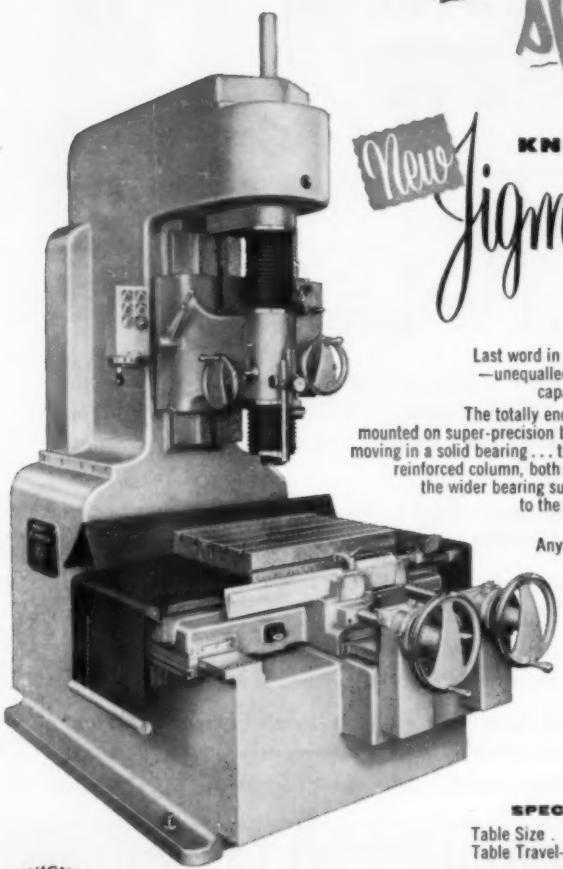
Two Federal instruments for machine tools have recently been introduced. One is for grinder control, and is available for cylindrical, center type and internal units. One of the center type grinder control units is an Air-Electric Gage with a jump-on caliper which engages the work automatically while it is being ground. The gage unit controls the rate of wheel feed in accordance with size signals. When finish size is reached, the control retracts the wheel.

A second Federal instrument is the Distometer, a long-range indicating device for use on lathes and other machine tools. It accurately measures the travel of the machine carriage in relation to any given point on the machine bed.

Federal Products Corp., 1144 Eddy St., Providence, R. I. **T-4-1782**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Compare this latest jig borer for capacity accuracy speed!



New KNIGHT'S Jigmaster

Last word in medium size jig borers—unequalled for extreme accuracy, capacity, increased output.

The totally enclosed spindle and quill mounted on super-precision ball bearings, with quill moving in a solid bearing... the extra-wide base and reinforced column, both cast as a single unit... the wider bearing surfaces... all contribute to the Jigmaster's exceptional rigidity and accuracy.

Any one of three table and saddle locating devices may be used for hole location. All machine controls can be operated from a single convenient location.

Write for Complete Information

SPECIFICATIONS

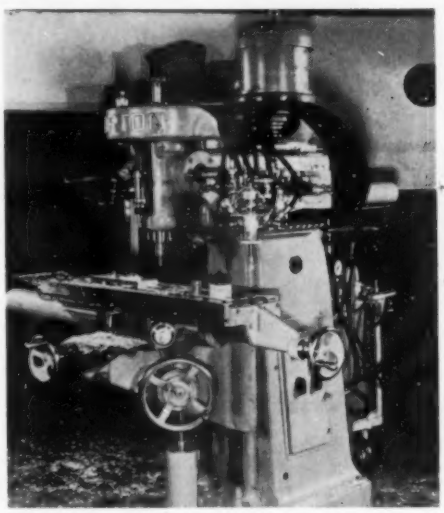
Table Size	18" x 24"
Table Travel—Longitudinal	20"
—Cross	15"
Vertical Capacity	23"
Throat	20"
Weight	7500 Lbs.

KNIGHT VERSATILE

W. B. KNIGHT MACHINERY COMPANY
3918 West Pine Blvd. St. Louis 8, Mo.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-178

Milling Machine



Three-dimensional motion, plus the added feature of retaining the existing manual feed screws, are incorporated in the design of the Gorton Model 9 J Mill utilizing the True-Trace A-3D tracing instrument.

True-Trace Sales Corp., 9830 E. Rush St., El Monte, Calif. **T-4-1783**

Abrasive Media

A controlled size, shape and grit abrasive media, called Speed-D-Burretts, permits barrel finishing of parts that formerly could not be finished in such equipment. Special compounding of high-quality synthetic rubber and pure aluminum oxide results in media that produces abrasive action in remote corners and recesses of a part without risk of chipping, splintering or cracking into odd shapes and sizes. Complicated precision parts may be barrel finished without damage or loading. In addition, there is no need for continuous sizing of media.

In making Speed-D-Burretts, pure aluminum oxide with precision controlled grain or grit size is kneaded into the raw or uncured rubber. The material is then molded, formed or rolled to a diamond, rectangular ball or



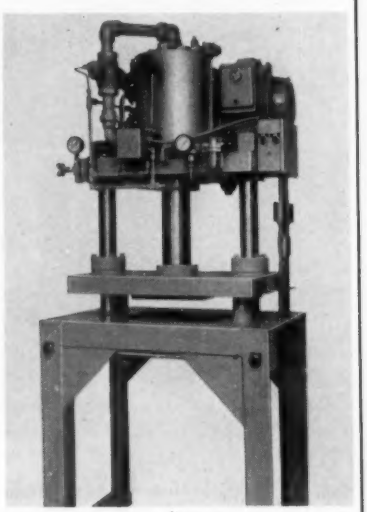
square shape and cured to a precise Shore hardness for maximum cutting, honing or polishing action. Important feature of the media is its long life.

It is available in a wide range of popular sizes, shapes and grits.

Speed-D-Burr Corp., 3613 San Fernando Rd., Glendale, Calif. **T-4-1791**

Hydraulic Trim Press

Stamping, swaging, staking and broaching operations are all done on this hydraulic trim press which has a



capacity of 20 tons with a 12-in. stroke. The clear platen area is 24 x 18 in., with a 15 x 15-in. cutout in the bottom of the platen. Other models of the press are available from 20 to 100 tons with various daylight, stroke and platen area



Cut DIE COST WHERE IT'S IMPORTANT...

...BEFORE the design gets off the board

Save die designing time with Detroit Die Set time savers. Easy-to-use catalog puts all needed information *flat* in front of you. Heavy paper die set templets (free on request) quickly determine size—save drafting time. Just slip under layout and trace most economical size for the job.

For more difficult jobs, a Detroit Die Set engineering representative is as near as your phone. He can quickly answer questions about special die sets, bushings, etc.

Start cutting die design cost now. Specify Detroit Die Sets. Available in all sizes and materials. Precision or Commercial tolerances. Stock die sets shipped within 24 hours. Unusually fast service on specials, too.

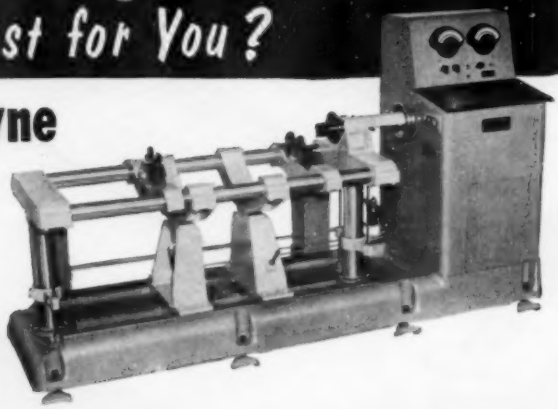
Offices in Principal Industrial Centers

Detroit DIE SET CORPORATION

2895 WEST GRAND BOULEVARD • DETROIT 2, MICHIGAN

Which of These OLSEN Balancing Machines Is Best for You?

ElecΦdyne



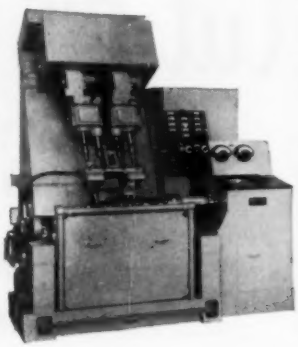
Horizontal Static-Dynamic Balancing Machines.

21 models for parts from 3 oz. to 5,000 lbs. or more.



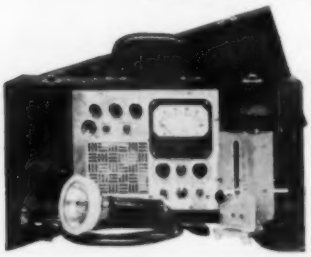
ElecΦdyne

Vertical Static Balancing Machines. Optional drill unit for rapid correction.



Automatic

Balancing Machines. 30 or more crankshafts per hour corrected to within 0.25 oz.-in.



VibrΦdyne

. . . a new concept in Vibration Analysis and Correction. Fast, accurate "in-place" balancing.

No matter what your requirements, there's a Tinius Olsen Balancing Machine that will cut your balancing time and costs to an astonishing minimum. It will pay you to get the facts about the complete line of Olsen ElecΦdyne Balancing Machines for high speed, low cost production line balancing. Write for Bulletin 49 today.

For further information about the new Vibrodyne Vibration Analyzer and Balancer, send for Bulletin 53.

TINIUS OLSEN TESTING MACHINE CO.
2110 Easton Road · Willow Grove, Pa.
Testing & Balancing Machines

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dimensions.

Addition of a hopper makes the trim press suitable for automatic molding of plastics, powdered metals and ceramic products. A conveyor feed for automatic operation, or a rotary table can also be accommodated.

The small, compact unit uses both static air and hydraulic pressure. A 3-hp motor is used in the drive.

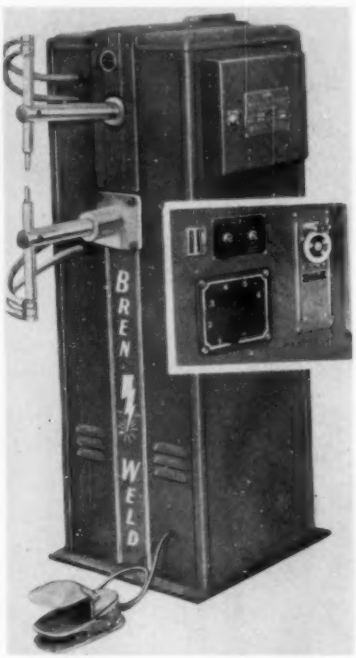
Traverse speed, up to 600 ipm, and pressing speed, up to 35 ipm, are adjustable.

Mohler Co., 3460 Glendale Blvd., Los Angeles 39, Calif. **T-4-1801**

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Automatic Spot Welder

Two pieces of ⅛-inch steel can be welded by the Bren/Weld SP-100 air-operated, fully automatic spot welder. This low-cost unit welds 18-gage steel at 100 spots a minute, lighter gages as



fast as it can be fed. Feature of the unit is its patented transoidal transformer, which gives this transformer welder a power factor of 70 percent.

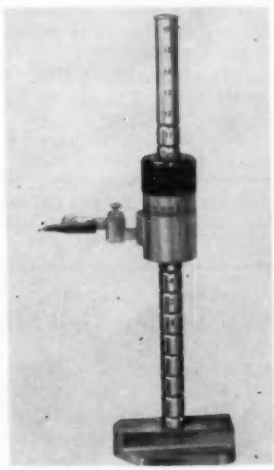
Other features include: repeat, non-beat operation; NEMA type 1AX timer; heavy-duty, double-acting air cylinder with adjustable speed control in both directions; and welding horns

which can be moved in and out, and rotated 360 deg. Controls are mounted on a single, side panel for convenience. A self-compensating pressure switch automatically cares for adjustments when air pressure is changed.

Brennen, Bucci and Weber, Inc., 262 Mott St., New York 12, N. Y. **T-4-1811**

Height Gage

The Height Master is an independent, self-contained instrument which does not require gage blocks or transfer measuring equipment. It can be set to thousandths in only a few seconds, and is easily locked at any desired inch measurement. By merely turning the thimble on the instrument, the desired



hundredth is registered on a vertical scale and the desired thousandth lines up on the horizontal scale.

The Height Master is read directly without disturbing the instrument; the inch, hundredths and thousandths readings are taken from three sharply defined measurement scales.

Models No. 1710 and 1705 both have a range of measurement graduations from 2 to 17 inches; Model 1710 reads directly to 0.001; Model 1705 reads directly to 0.0005.

Pacific Gage Co., 6501 Avalon Blvd., Los Angeles 3, Calif. **T-4-1812**

Bandsander

A modernized sanding, deburring and grinding machine is designed to allow quick change of abrasive belts, tilting of the table top, self-alignment of pulleys, spring belt tension, and the ability to pass the belt through cutout openings to sand inner edges. The new

REED

All the Foremost Spark Plugs

Have Threads

Rolled Exclusively on

REED MACHINES









COMPLETELY AUTOMATIC

Reed machines roll threads on the thin wall of spark plug shells with electrode already welded in place. Threads must be square with shoulder on part.

Rolled threads are superior. They are uniformly accurate, smooth and stronger—also more economical to produce.

Reed machines, used for both thread and form rolling, are made in 2 die horizontal and 3 die vertical types for in-feed or thru-feed rolling. They are rugged, of compact construction, easy to set up, convenient and simple to operate.

Equipped for manual, semiautomatic or fully automatic feeding, Reed machines are suitable for both small job lots and large production runs.

Write for Thread and Form Rolling Bulletin

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

WORCESTER 1, MASSACHUSETTS, U.S.A.

Sales Offices In: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

187

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-181



The Lepel line of induction heating units represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating. With a background of half a century of electrical and metallurgical experience, the name Lepel has become the symbol for quality in induction heating equipment embodying the highest standards of engineering achievement, dependable low cost operation and safety.

If you are interested in the application of induction heating you are invited to send samples of the work with specifications of the operations to be performed. Our engineers will process these samples and return the completed job with full data and recommendations without any cost or obligation.

TYPICAL INDUCTION HEATING APPLICATIONS



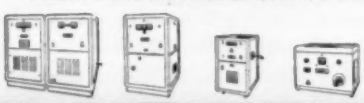
A widely used application in which several assemblies, consisting of a brass body, six radiator fins and a mounting stud, are being soldered simultaneously. The production of similar parts can be further increased by using two work coils and a change-over switch.

The illustration shows a lens grinding block being heated within the dome-shaped work coil. The heat generated in the metal block softens the pitch enabling the operator to remove the ground lenses and insert the next batch. The entire operation is completed in a few seconds.



Electronic Tube Generators—1 KW; 2½KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.
Spark Gap Converters 2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

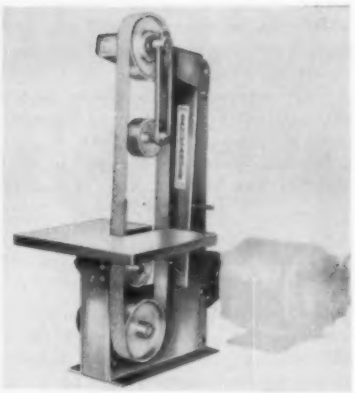
WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.



All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-182



model uses either 1 x 42-in. or 1 x 44-in. belts for both inside and outside grinding. It is equally useful for roughing out coarse cuts or for final finishing work on metal, plastic or wood; only the belt need be changed to provide the proper grit for the job.

Mead Specialties Co., Dept. B-74, 4114 N. Knox Ave., Chicago 41, Ill.

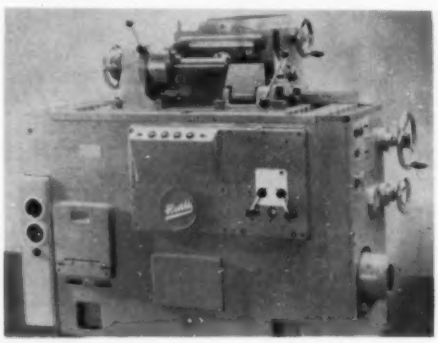
T-4-1821

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Keyway Milling Unit

Operation of this machine for milling accurate keyways and slots at high speed is fully automatic and requires only hand loading and unloading of the workpiece.

Milling time on a keyway ⅝ x 2 x ¼ in. is approximately 1 minute. At the



end of the milling cycle, the machine stops automatically, operator changes workpiece and a new cycle begins.

Rigid construction and vibration-free operation, even when taking heavy cuts, assure dimensions and good surface finish. Because of its high-speed operation, the Hurth Miller is equally

FOR THE BUSINESS END OF THE Automatics

WILLEY'S TUNGSTEN CARBIDE TOOLS



For **PROFIT PRODUCTION** and **LONG, NON-STOP** runs... Willey's Tungsten Carbide Tools best meet the demands of Modern Automation.

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Specialists in Preformed Carbide Shapes and Tools to Blueprints

WILLEY'S CARBIDE TOOL CO.

1340 W. Vernor Hwy. • Detroit 1, Mich.

INDICATE A-4-183-1

suited to either quantity production or small-lot milling.

Large scales simplify setting of length, width and depth. Twelve spindle speeds, from 180 to 2240 rpm, and 12 longitudinal feeds are provided.

Normal length of the stationary worktable, which is an integral part of the ma ' ine, is 49½ in. but can be increased to either 70 or 88 in. if required. Length of milling stroke, however, cannot be increased. Large chutes in the table aid in chip removal.

Operation is hydraulic against limit stops, with a setup accuracy of 0.0002 in. Gear drives are controlled by electromagnetic clutches for the individual operations.

Kurt Orban Co., Inc., 34 Exchange Pl., Jersey City 2, N. J. **T-4-1831**

Resin for Pattern Fillets

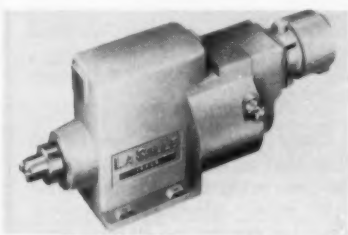
An epoxy trowelling resin provides a fast, economical means of making smooth pattern fillets.

This evenly flowing #630 offers desirable results, including good matching and blending of radii. It can be tooled in place by spreading the epoxy resin over the pattern and making the fillet from it by a waxed, chrome-plated spherical ball. The resulting fillets are said to bond permanently in place without shrinkage and provide exceptional durability for all types of patterns.

Marblette Corp., 37-21 Thirtieth St., Long Island City 1, N. Y. **T-4-1832**

Automatic Power Wrench

This 2-speed, fully automatic power wrench with controlled torque is synchronized with a machine cycle to automatically engage and disengage

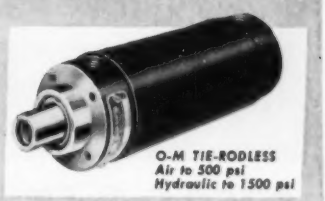


parts. Controlled torque provides precise clamping pressure.

A self-contained unit, the power wrench is automatically lubricated and operates on conventional machine tool principles. It features a fluid-motor drive to permit clamping of light parts, or parts with thin-walled areas, without

ORTMAN-MILLER Cylinders

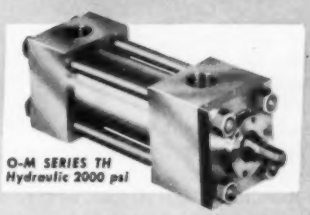
- Air and Hydraulic
- Meet JIC Standards



O-M TIE-RODLESS
Air to 500 psi
Hydraulic to 1500 psi

O-M Tie-Rodless (air-hydraulic) with compact space-saving design due to O-M Special Interlocking Mechanism, eliminates bulk . . . saves up to ½ installation space. Interlocking feature also makes it easy to orient ports, disassemble, inspect, clean, repair, assemble, thus reducing maintenance.

Available in complete range of sizes (1½" to 8" bores), with standard 2 to 1 or oversize rods. All steel construction with bearing bronze. Completely interchangeable parts and mounts, as described in Bulletin No. 101A.



O-M SERIES TH
Hydraulic 2000 psi

O-M Series TH—heavy duty hydraulic type rated at 2000 psi—features heavy walled seamless steel tubing and rolled steel heads accurately machined and recessed to confine the tube and prevent breathing. A multiple lip self-compensating rod gland packing, contained in a removable cartridge, facilitates replacement.

Available from 1½" to 8" bores as described in Bulletin No. 105.

Engineering Service—

Consult an Ortman-Miller representative regarding your pneumatic and hydraulic problems. His broad experience with standard and special cylinder applications is available to you without cost or obligation. Use convenient coupon for name and address of O-M representative nearest you.



Mail coupon today for Bulletins 101A and 105

ORTMAN-MILLER MACHINE CO.

13 143rd Street, Hammond, Ind.

☐ Have representative call
☐ Send Bulletins 101A and 105

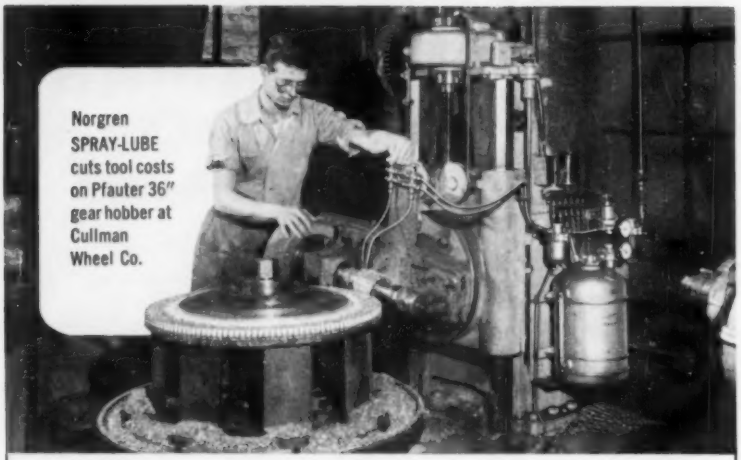
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Company_____

Address_____

City_____ Zone____ State_____

INDICATE A-4-183-2



$250 Saved Yearly in Lubricant Alone
on Each Gear Hobber with SPRAY-LUBE*

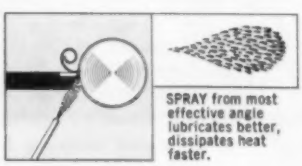
...Cullman Wheel Co. also reports substantially increased tool life, safer, cleaner working conditions, less machine cleanup time.

Cullman Wheel Company in Chicago is a leading manufacturer of chain drives and other power transmission equipment. Dissatisfied with the performance of flood systems of tool lubrication, they tried Norgren SPRAY-LUBE on one of their gear hobbers.

Results of the trial were so favorable that they at once began converting the coolant systems on other gear hobbers and shapers to Norgren SPRAY-LUBE.

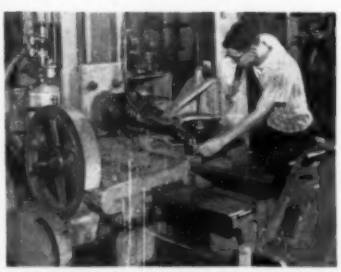
Today, from the many SPRAY-LUBE applications in their plant, they have reported the following facts:

Norgren SPRAY-LUBE applies a spray of cutting oil upon the close interfaces at the cutting area, providing a more thorough lubrication at the cutting point between the tool and work piece. As a result, tool life has substantially increased.


SPRAY from most effective angle lubricates better, dissipates heat faster.

SPRAY-LUBE sprays lubricant exactly where it is needed with no waste. It does a much more thorough lubricating job, using considerably less lubricant. In fact, savings in lubricant cost alone are averaging $250 a year per machine —enough to pay for the Norgren SPRAY-LUBE System in about 6 months.

In addition, SPRAY-LUBE has provided other valuable advantages —improving product finish . . . simplifying chip removal . . . reducing machine cleaning time . . . and providing safer, cleaner floor conditions around the machines.


Norgren SPRAY-LUBE saves nearly $250 a year in coolant cost on Gould & Eberhardt gear shaper.

Without obligation, learn how Norgren SPRAY-LUBE can reduce costs in your plant. Call your nearby Norgren Representative listed in your telephone directory — or **WRITE THE FACTORY FOR BULLETIN 537.**

C. A. Norgren Co.
3447 So. Elati St., Englewood, Colorado

Pioneer and Leader in Oil-Fog Lubrication Since 1930

For complete information about this application, write for Norgren Blueprint SL-7.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-184

danger of damage. Clamping torque can be repeated from cycle to cycle within ten percent.

The wrenches are designed to fit any special or standard machine and permit vertical, horizontal or angular mounting.

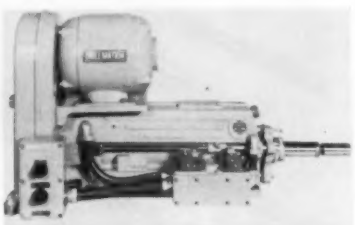
Two standard sizes are available: a small model, with torque capacity from 0 to 800 lb-in., and a large model with a torque range from 800 to 5000 lb-in.

Lasalle Tool Inc., 3840 E. Outer Dr., Detroit 34, Mich. **T-4-1841**

Deep Hole Driller

An addition to the Drillmation line of machine tool package type power units is this self-enclosed, hydraulic feed power unit for deep hole drilling in crankshafts, camshafts, etc.

In this unit, drilling steps or increments can be preset to any depth multiples; because of a rapid approach and return there is no need for further adjustments. There is no appreciable heat rise due to a locked-circuit feed. It can drill any number of holes in alloys up to 40-C Rockwell hardness. The drill spindle and pumps are integral and in line with the drill thrust. Standard units have a 10-inch stroke.



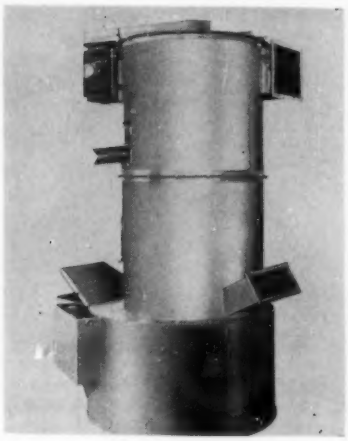
Drillmation Co., 21511 John R Street, Hazel Park, Mich. **T-4-1842**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Wet Type Dust-Fume Collectors

A dust-fume collector unit has been developed with a cone and baffle design which is said to result in a "cyclonic" washing action, creating a turbulence which separates the wet dust and carries it to a sludge tank for removal.

A series of water curtains is created, through which the dust and fume laden air is filtered in its upward travel. A double row of moisture eliminators is



mounted above the washing chamber.

Flat bottom incorporated in its design serves as a settling tank from which the water is recirculated. A chute type cleanout is provided for simple hand cleaning of settling tank. These wet type dust-fume collectors are also produced with flight conveyors for automatic ejection of sludge from tanks to containers.

Several models are available in sizes and capacities from 500 to 40,000 cfm, to meet a variety of individual needs.

The Zack Co., 4600 W. 12th Pl., Chicago 50, Ill. **T-4-1851**

Multipress

A one-ton multipress is designed primarily for cost reduction. Versatility of the unit permits its adaptation to many applications. It has been designed to fit into automatic lines working in conjunction with various types of feed mechanisms.

Ram pressure of the machine can be quickly set from 500 to 2000 lb. A dual electric control system insures safety, as the unit will operate only when both hands are on the actuating buttons.

Maintenance is easy and simple. Checking the lubrication and hydraulic oil periodically is all that is necessary.

Denison Engineering Co., Columbus, Ohio. **T-4-1852**

Linear Speed Indicator

The Jaquet indicator, an unusual chronometric hand tachometer, is designed to read directly in inches per minute, requiring no calculations.

This speed indicator has been specially made for measuring slow linear speeds where precise setting of speed is important.

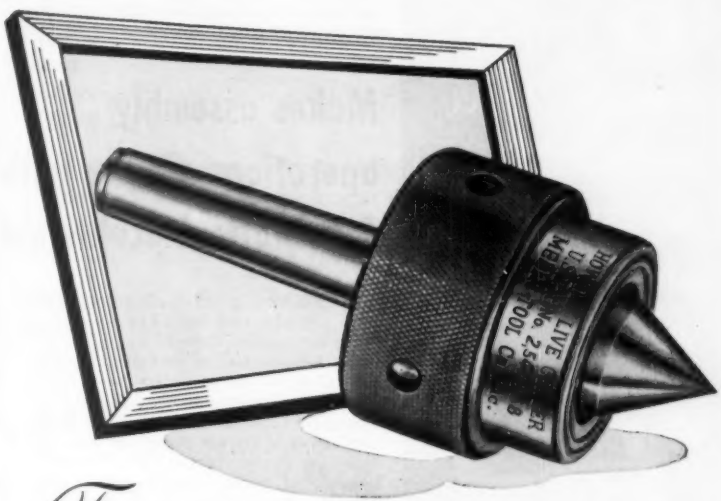
The instrument covers all speeds from 0-300 ipm. Accuracy of the instruments is said to be ½ of 1 percent. To determine speed, it is only necessary to hold roller head against moving member. After a 6-sec interval, reading is indicated by stationary hands. Smallest division on dial represents ¼ ipm.

These indicators can also be used for rotational readings by means of pointed tips which are included.

Herman H. Sticht Co., Inc., 27 Park Pl., New York 7, N. Y. **T-4-1843**

Die Filer

A Keller die filer, featuring a wide capacity, self-compensating chuck, holds ⅛-in. diam up to ½ x ⅝-in. files. Its roller support has full 6-in. adjustment for maximum accuracy when using long files. A worktable, 8½ x 8½ in., tilts up to 15 deg in any direction. There are two speeds provided—350 and 450 spm. Length of stroke is 1½ in. A deluxe model has both file roller support and an overarm for filing, saw-



Finest **LIVE CENTER MADE**

. . . HERE'S WHY

★ BACK UP RING assures positive rigidity.

★ Bar Expansion Eliminated by means of Thrust Spring.

★ Special alloy tool steel spindles, hardened and ground.

★ Matched precision ball bearings, mounted in tandem.

★ Oil impregnated bronze tail bearing.

★ Points pre-loaded and ground after assembly.

★ A distinctive oil seal in front of bearings protects them from all foreign matter. Chips, dirt and cutting oil cannot reach the bearings.

The HOWARD Live Center is the *ONLY* center that offers the patented *BACK UP RING*. The Ring maintains solid contact between the quill and head of the center . . . thus greatly increases over-all rigidity.

Send for the new MELIN TOOL Catalog No. 54-C . . . it lists, in addition to specifications and prices on the HOWARD Live Center, the complete MELIN TOOL End Mill Line.



MELIN TOOL COMPANY, INC.
3372 West 140th St.
Cleveland 11, Ohio

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-185

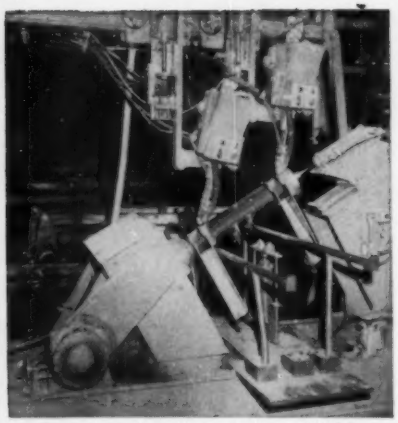
When a line of automatic welders for AC or DC operation

Has the most sensitive controls for fast starting and uniform welds

Yet is easiest to adapt to any fixture

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Automatic Lincolnweld *producing 2 hidden arc girth welds simultaneously for welded assembly of automotive components.*

Makes assembly operations simple with Automatic Lincolnweld

HERE two girth welds are made simply and quickly by using Automatic Lincolnweld heads . . . at speeds of 30 inches per minute. The assembly of the arms to the tube is first tack welded and then loaded between centers. The Lincolnweld heads are lowered by air plungers and the welding cycle started. The weld is completed in a single pass using Lincoln L-60 mild steel electrode wire and Lincoln 780 Agglomerated Flux.

Cost reductions are possible on virtually all types of fabrications with Automatic Lincolnweld.

Three types of Lincolnwelds are available: LAF-3 and LAF-5 for DC welding, LAF-4 for AC welding. Write for Bulletin 1355 for complete data on Automatic Lincolnweld.

THE LINCOLN ELECTRIC COMPANY

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☐ Send me Bulletin 1355 on Automatic Lincolnweld.
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Name_____
Position_____

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-186



ing and lapping. The standard model, illustrated, is equipped with file roller support or available with overarm. A low-cost model has neither file roller nor supporting arm.

Sales Service Machine Tool Co., 2363 University Ave., St. Paul 14, Minn.

T-4-1861

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Copying Shaper

This hydraulic shaper is template controlled for machining external contours. Short-run contoured pieces and others are made quickly and accurately



with setups no more complex than those on a conventional shaper.

In operation, the template is fixed on the headstock and is engaged by a stylus that actuates the table through a hydraulic valve. Rotation of the template moves the follower. This positions the table to conform to the template contour, and the work, held between centers on the table, is thereby correctly positioned under the cutter on

the reciprocating ram.

Ram stroke is about 11 11/16 in. and maximum work length, 11 in. Largest diameter piece that can be accommodated is 7 13/16 in. Strokes per minute run 30, 60, 90 and 180, while rotary work feed is adjustable from 1½ to 198 degrees per minute.

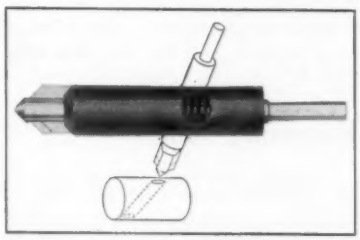
Haller Inc., Plymouth, Mich.

T-4-1871

Deburring Tools

The Ellipti-Burr is designed for the deburring and chamfering of accessible hole faces having irregular surfaces.

The new self-piloting tool is a two-lipped cutter, which automatically follows any hole surface geometry. The pilot is conical and accommodates any hole size within its working range. The cutter blade, with two diametrically



opposed cutting edges, is supported to permit both radial and axial displacement.

Operating speed within the range of 75-200 rpm is recommended, depending on the individual operation and type of material. Tools may be operated by portable air or electric drill motors, or in a machine tool spindle, and are readily adaptable to multiple-spindle operation.

Nobor Mfg. Co., Dept. TE, 6860 Farmdale Ave., North Hollywood, Calif.

T-4-1872

Vacuum Sintered Steel-Cutting Carbide

Two new carbide grades, Series 8-A for roughing cuts and 6-A for finishing cuts, have been specifically designed for machining tough, alloy and high-tensile strength steels. These vacuum sintered carbides are said to permit 30 percent higher feed and speed rates in steel-cutting operations because of greater edge strength coupled with unusual wear qualities and a greater resistance to cratering.

During a job test, Willey's grade 8-A produced eight times more finished

DO YOU NEED ANSWERS TO THESE QUESTIONS?

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3 How can I reduce rejects due to faulty electrocleaning of zinc die castings?

***Answer* 1** Following an Oakite recommendation, one plater made a small change in his steel-cleaning cycle and soon had two tankfuls of cleaning solution doing the work of three—and the plate adhesion was improved. *See booklet offered below.*

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***Answer* 3** Oakite has an anodic conditioner that offers brighter plating of zinc die castings . . . with no anodic blackening and fewer rejects. *See booklet offered below.*

FREE For more information about the electrocleaning of steel, brass or zinc die castings, ask for one or all of the booklets listed in the coupon.



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Send me the free booklets I have checked below:

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☐ "Good news about electrocleaning zinc-base die castings"

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Standard
JIG & FIXTURE COMPONENTS
complete line—over 500 parts
"FIXTURES IN A JIFFY"

"T" ANGLE PLATES

Our "T" Angle Plates have many applications as milling fixtures, comparator stands or drill jigs. The addition of a few special parts make this a complete fixture at little cost. Normalized, precision-machined castings—7 standard sizes.



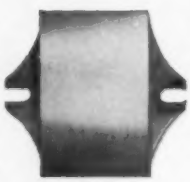
BOX JIGS



Standard's Box Jigs are made in either square or rectangular styles in 9 sizes. It will pay you to have them on hand in several sizes.

MILL FIXTURE BASES

Mill Fixture Bases are available in a variety of sizes. All are normalized and precision-machined. They are furnished with either standard keyways, or jig-bored holes for "Sure-Lock" Fixture Keys at no extra cost.





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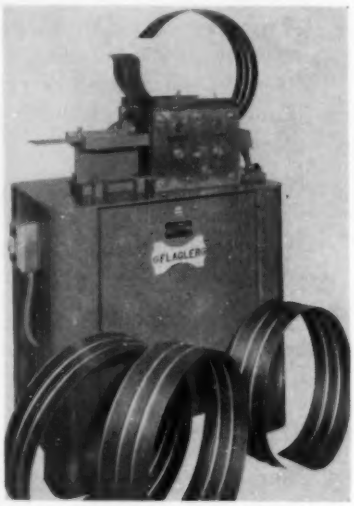
pieces per grind, four more regrinds per tool, lowered machine down time by 200 percent and reduced the cost per tool of finished pieces.

Both series are available from stock in all standard blank sizes.

Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich. **T-4-1881**

Special Sheet Metal Roller

A compact, high-capacity sheet metal rolling machine has been developed to form a fan shroud complete in 6 seconds. Two circumferential corrugations



are formed in the metal as it is being rolled to the desired diameter.

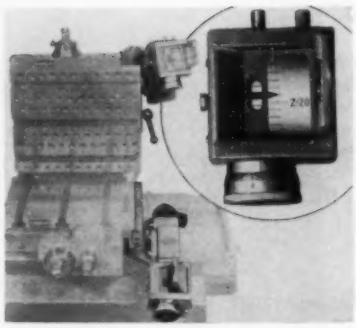
Incorporated in the machine is a sensitive adjustment which compensates for various materials and radii. Rolls are independent units and can be readily replaced.

The Flagler Corp., 19321 Filer Ave., Detroit 34, Mich. **T-4-1882**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Circular Table

A Microptic circular table has been developed through cooperating efforts of Coventry Gage and Tool, and Hilger & Watts. The projection unit of this 18-in. projection model is built into the table and is completely sealed from dust, oil and the heat of the lamp. The optical micrometer breaks down the ten-minute divisions on the main glass



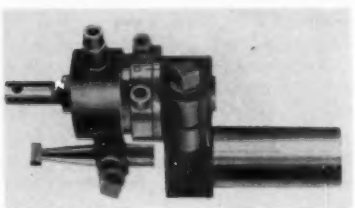
circle into 200 parts, to give a direct reading to 3 sec. Estimation can be made to one and one-half seconds.

The top surface of the table is flat and parallel to the base within 0.0003 in. The unit can be mounted on an inclinable table for which inclinations are controlled by a Microptic precision clinometer reading directly to 10 sec with estimation to 3 sec.

Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. **T-4-1883**

Recessing Tool

Recently introduced recessing tool for automatic screw machines and turret lathes is available in three standard sizes—⅝, ¾ and 1-in. shanks. It can be adjusted to operate on any internal



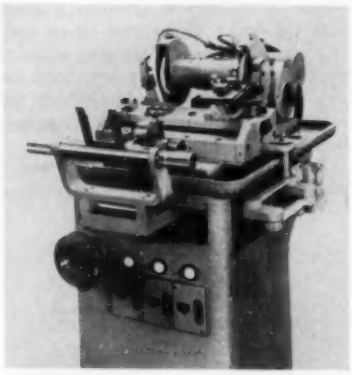
diameter within capacity of machine. It also is adjustable to operate on outside diameter for such work as cutting grooves, chamfering or cutting clearance at end of threads. Important feature of the tool is that it may be operated with spindle running right or left.

R and L Tools, 1825 Bristol St., Philadelphia 40, Pa. **T-4-1884**

Copy Grinding Machine

Two duplicate lathe tools, form tools, profile gages or production parts may be ground simultaneously in one simple operation on the recently introduced Copyrex copy grinding machine.

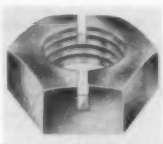
An easily made template, enlarged



5 times, effects the copying process through a parallelogram linkage to the twin toolholders holding the workpieces. A pair of diamond dressers keeps the wheels trued for accurate grinding. A cylindrical grinding attachment which permits grinding of circular pieces up to 4 in. in diam is also available.

Carl Hirschmann Co., Inc., 30 Park Ave., Manhasset, N. Y. **T-4-1891**

Free Running Locknut



One-piece, free spinning and reusable locknuts are being produced by automatic process to provide low cost quality product. The upper portion of the nut is slotted and the bottom face is undercut so that when the nut is tightened, the threaded upper segments move inward causing the nut to produce a vibration-proof lock on the threads of the screw.

All-metal construction serves as protection against effects of both oil and water.

Made of steel, brass, aluminum and stainless, the new locknuts are available in all machine screw sizes.

Jacobson Nut Mfg. Corp., Box 177, Kenilworth, N. J. **T-4-1892**

Spring Computer

The Calculaide spring computer correlates in one setting such variables in spring design as spring diameter, wire size in diameter and gage number, number of active coils, material and its torsional modulus *G*, maximum sheer stress, load and total deflection.

All figures are read off directly without any intermediate computation; no reference is made to a standard load, standard *G*, or a standard number of coils. The stress scale includes the correction for nonlinear distribution of torsional stresses in curved wires. The Calculaide also gives correct results for large deflections of extension springs.

Only 11 in. in length, this computer, made from sheets of tough, nonwarping dimensionally stable plastic, is a sturdy instrument unaffected by moisture, perspiration or ink, and is easily cleaned.

American Hydromath Corp., 25-20 43rd Ave., Long Island City 1, N. Y. **T-4-1893**

Four-Way Valves

This 4-way valve is operated by a solenoid controlled pilot which allows control of the spool movement at rates to assure operation without shock. The solenoid is fastened to the valve by the cover; therefore, electrical operation of the valve is prevented unless the cover is closed.

Balanced piston design gives balance in all directions with no side or end thrust. Sleeve type construction gives smooth continuous riding surface for the piston. Round holes in the sleeve permit a smooth throttled reversal. The holes can be elongated to increase throttling action. Because the area through the valve is equal to or greater than the area through connecting pipe, there is minimum pressure drop through the valve.



The valve is designed to withstand 2000 psi and will allow full back pressure on the exhaust port. Recommended capacity is 1¼ gpm.

Racine Hydraulics & Machinery Inc., Racine, Wisc. **T-4-1894**

Master Spacer

This high-precision multipurpose master spacer quickly and accurately indexes work for machining jobs.

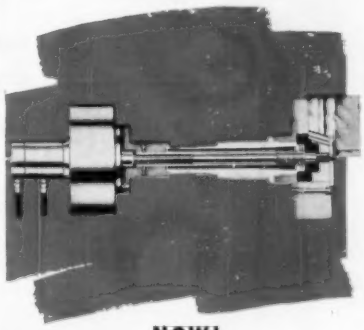
Indexing accuracy is within 0.001 in. cumulative error on a 6-in. diameter

NEW

SKINNER

"JUNIOR"

POWER CHUCKING UNIT



NOW!

Maximum production speed for your small lathes TOO!

This Skinner "Junior" unit can be adapted to almost any small lathe with 1" to 1⅜" hole through the spindle. It is light in weight, precisely balanced to minimize spindle bearing and braking loads, and provides extreme repetitive accuracy on internal and external work.

The Skinner 8" self-centering power chuck has gripping capacity from ¼" to 6". Its ¼" jaw travel exceeds the capacity of any collet, and is particularly valuable on production work where rough or finished holding diameters may vary beyond a single collet's ability to grip.

The Skinner "Junior" unit is complete. It contains chuck, 6" aluminum air cylinder, adapters, draw bar, etc.

Write Skinner or your nearest Skinner distributor for illustrated folder.

THE CREST SKINNER CHUCKS OF QUALITY

THE SKINNER CHUCK COMPANY

212 Edgewood Avenue, New Britain, Conn.

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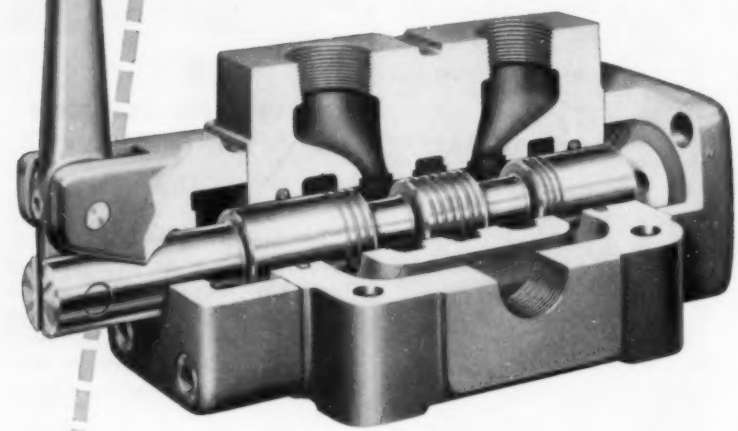
4-way cost control

① **Rugged Construction**
—long life

② **Full Flow Design**
—minimum pressure drop

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—smooth balanced operation

④ **Complete Range**
of sizes and types



H-P-M Directional Control Valves meet most demands for unqualified heavy-duty service. That's why economy minded design engineers choose time-tested, job-proved H-P-M hydraulic valves and controls for every hydraulic requirement in the 2000-3000 psi range. Heavy distortion-free bodies, smooth operating spools, wide choice of operating characteristics are available. Write today for complete catalogs—¼" to 4" sizes.

HPM

HYDRAULIC POWER DIVISION
THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-190

circle. Work may be trued in position with the brake off because when work is clamped, spindle alignment remains unchanged. Both brake lever and index plunger lever are located on the same side of the unit for easier operation.

Designed to be used either vertically or horizontally, the master spacer offers



good performance under heavy helical cuts and slow feeds.

Other features of the master spacer are a precision-ground 24-position index plate, hardened and ground index plunger, interchangeable masking plates and adjustable zero plate with degree graduations on the beveled face for visibility.

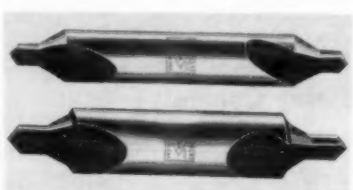
Erickson Tool Co., East 23rd and Hamilton Ave., Cleveland 14, Ohio.

T-4-1901

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Combined Drill, Countersink

A recently developed combined drill and countersink features spiral flute contruction designed to provide smooth,



accurate holes while providing unusually free cutting chip formation and efficient chip removal. The combined drill and countersink is available in the plain type in sizes 1 to 8, in high-speed or

carbon steel; and in the bell type, sizes 11 to 18, in high-speed steel only. Both types have spiral flutes.

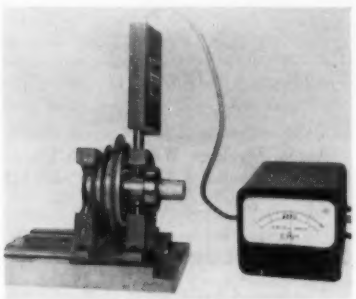
Diameters of drill sizes range from 3/64 to 1/4 in. with the length of the drill portion equal to that of the drill diameter.

Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich. **T-4-1911**

Electronic Micrometer

Unskilled workers can inspect as many as 3500 pieces an hour at tolerances less than 0.0001 in. with the Minitron electronic micrometer.

This all-purpose shop gage features 2 sets of adjustable anvils for accepting a production run for quick checking without feel. The gage stand may be quickly preset and locked to conform to a master. Pieces are then simply inserted and the position of the indicator noted to check diameter, concentricity and taper. It may be used easily to check off-balance or unwieldly pieces.



An electronic adjustment permits establishment of any magnification from 10,000X to 1,000X. There is no flicker, flutter or drift of the gaging indicator.

EAM Div., Industrial Gauges Corp., Englewood, N. J. **T-4-1912**

Angle Vise

The Palmgren No. 23B angle vise with swivel base affords quick, accurate setups at any angle without clamps, wedges, etc.

Jaw width of the vise is 3 in.; jaw opening is 3 in.; and jaw depth is 1 3/4 in. It can be used with or without the 360 deg graduated swivel base, and can be set at any angle from 0 to 90 deg in a vertical plane. It also can be used as an ordinary machine vise in the horizontal position.

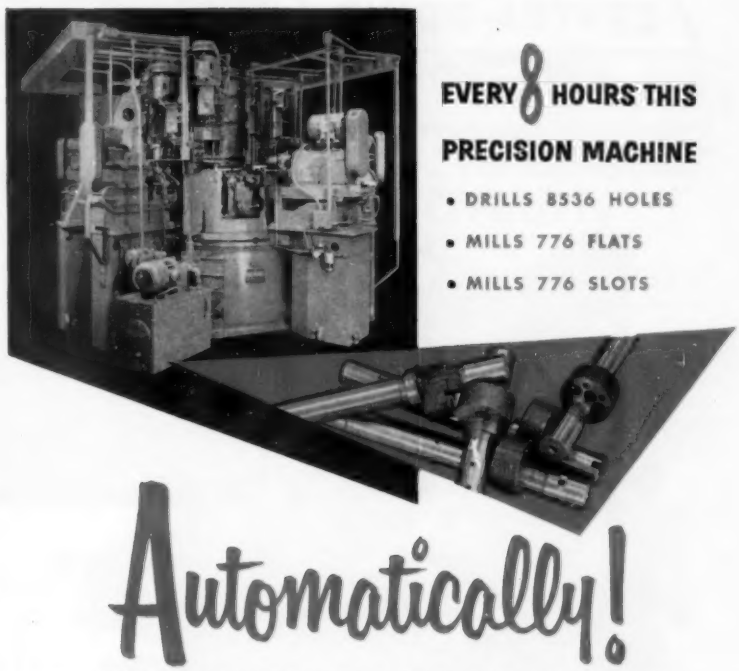
This angle vise was designed for production work, tool work, bench work for any operation where quick angle setups are necessary.



Chicago Tool and Engineering Co., 8383 S. Chicago Ave., Chicago 17, Ill. **T-4-1913**

Magnetic Work Holder

An adjustable magnetic work holder, for use on any machine equipped with a magnetic chuck, is constructed of alternating laminations of brass and iron, possessing high permeability and low



EVERY 8 HOURS THIS PRECISION MACHINE

- DRILLS 8536 HOLES
- MILLS 776 FLATS
- MILLS 776 SLOTS

Automatically!

This MORRIS Model 322-S High Production Machine produces 97 refrigeration compressor crankshafts per hour at 80% efficiency. In each part it automatically drills 11 holes, varying in diameter from .125" to .375". Six holes, including one hole 4 3/4" deep, are drilled using gun drilling techniques. In addition, the machine mills one end slot and one chordal flat on the shaft.

These operations are coordinated through use of a MORRIS basic center column machine, equipped with a 48" dia. table, a 12-station automatic indexing mechanism, and 16 MORRIS AIR-OIL-Matic and Cam-Matic Drill Units.

The result is a completely automatic "special" machine, designed using a standard basic machine and standard drill units . . . at a fraction of the usual special machine cost.

WRITE TODAY for detailed literature, or outline your production problem for analysis by MORRIS engineers.

See our insert in Sweet's Machine Tool File

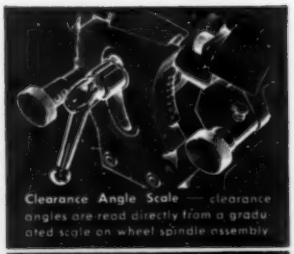
Morris MACHINE TOOL COMPANY
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CINCINNATI 3, OHIO

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Only Cutter Grinder in the WORLD with all these features

END MILL CENTRA·POINT GRINDER ®

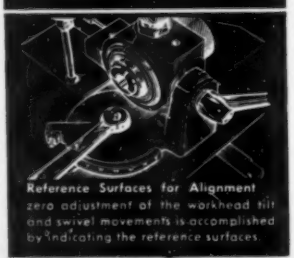
Specifically designed for sharpening the small cutters that are so difficult to grind on large machines, CENTRA-POINT is fully described in Bulletin M-55.



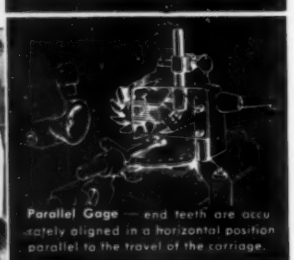
Clearance Angle Scale — clearance angles are read directly from a graduated scale on wheel spindle assembly.



Mechanical Wheel Dressing — an accurate radius is mechanically dressed on the grinding wheel, in correct relationship to self-registering tooth rests.



Reference Surfaces for Alignment — zero adjustment of the workhead tilt and swivel movements is accomplished by indicating the reference surfaces.



Parallel Gage — end teeth are accurately aligned in a horizontal position parallel to the travel of the carriage.



CENTRA-POINT DIVISION

William H. Field Co., Inc., 328 Dorchester Ave., Boston 27, Mass.

Please send a copy of the new CENTRA-POINT Data Sheet.

Name _____ *Title* _____

(Please Print)

Company _____

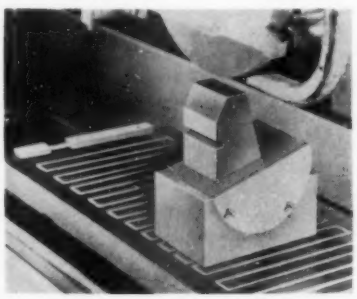
Address _____

City _____ *Zone* _____ *State* _____

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-192

residual magnetism, and fused to precision exactness.

Work is secured on the flat ground face of the adjustable holding block which is rotated by hand to the required angle. The angle is quickly and easily set with the aid of a protractor and planer gage. For future reference, the position setting need only be recorded from the planer gage reading. This height setting may be varied in small angle increments to assure the accuracy necessary for precision machining.

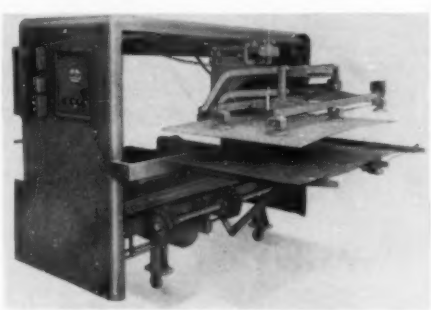


Anton Machine Works, 1226 Flushing Ave., Brooklyn 37, N. Y. **T-4-1921**

Sheet Feeder

A standard basic sheet feed unit has been developed to feed a single sheet of steel to a punch press automatically.

Air-operated with 110-volt electrical control, this machine is capable of handling up to 30 steel sheets a minute, depending upon the size of the blank. It will take sizes ranging from a blank of 8 in. in diameter to a sheet of 48 x 144 in.



Like other units in this line, the feeder is self-contained and completely movable. Its controls can be interlocked with those of the presses, and with those of other units.

Hamilton Automation, Inc., Hamilton, Ohio. **T-4-1922**

Counterbores from Stock

Counterbores and countersinks are being made available for use with Continental standard drive holders which are designed to hold cutters rigidly while the work is in process, yet to permit instant changes. A cutter can be detached or inserted by hand merely by a twist of the wrist.

Boxed sets of counterbores, countersinks or holders are stocked for immediate delivery. These sets are of particular advantage where a fairly broad range of sizes is needed, but it is not practical to keep large quantities of tools on hand. Cutter and holder assortments are assembled in graduated sizes to anticipate types of work each set will be called upon to do.



Continental Tool Works Div., Ex-Cell-O Corp., Detroit, Mich. **T-4-1931**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Belt Grease

Kocour belt grease, a uniform, chemically controlled compound has been developed as a polishing aid for abrasive belt operation on both ferrous and nonferrous metals. Nonloading properties maintain a film on the abrasive surface, thus preventing metal particles which normally adhere to cutting points from loading up the abrasive surface, minimizing dulling of abrasive grain on the belt. The substance will not clog the belt. Operation and maintenance is much cleaner, and use of inflammables as a lubricant or wash is avoided.

Kocour belt grease is available in paper tubes, 2½ x 8½ in., each weighing approximately 1¼ lb and can be supplied in any quantity.

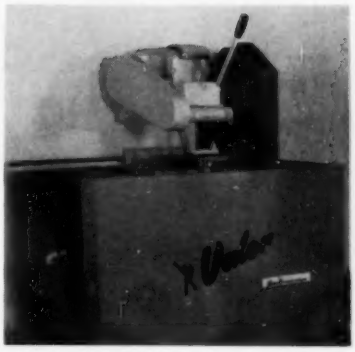
Kocour Co., 4800 S. St. Louis Ave., Chicago 32, Ill. **T-4-1932**

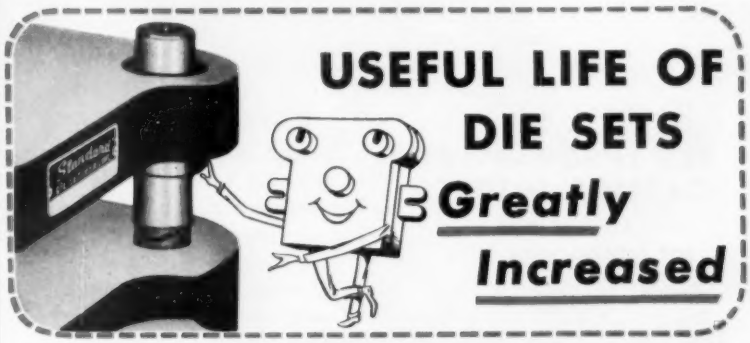
Cutoff Saw

The Valor saw, designed to meet many metal cutoff problems, has a 5-hp motor and multibelt drive to assure smooth easy cutting of both ferrous and nonferrous materials with minimum burr and need for remachining.

The large bed and 16-in. blade offer versatility to accommodate various material sizes. The swivel cutting head and unusual material clamp allow cutting at angles up to 45 deg with material remaining horizontal.

The saw is equipped as standard for





by "Standard"

CHROME-COATED POSTS

For over FIVE YEARS experienced diemakers have rated chrome-coated posts a major factor in the superior performance of "Standard" Die Sets.

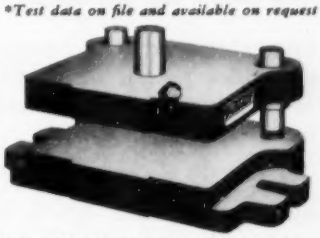
Recent laboratory tests* conducted by a nationally known research organization, *prove* that "Standard" Chrome-Coated Posts

(1) Reduce harmful friction
(2) Reduce wear between post and bushing, preserving close tolerances much longer than when posts are not chrome-coated.

Compare these facts and other "Standard" advantages for yourself. Send for the new "Standard" Die Set *Comparison Chart* and Catalog today.

STANDARD DIE SET MANUFACTURERS, INC.
1487 Elmwood Avenue, Providence 7, R. I.

**Test data on file and available on request*



There's a difference in die sets and "Standard" makes the difference!

MAIL THIS COUPON NOW

STANDARD DIE SET MFRS., INC.
1487 Elmwood Avenue
Providence 7 R. I.

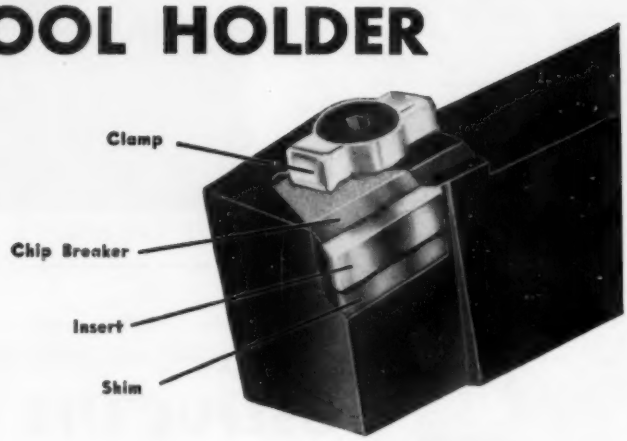
Please send me your
☐ Comparison Chart ☐ Die Set Catalog
☐ Sample "Standard" Die Makers' Grease

Name.....
Title.....
Company.....
Address.....
.....

BRANCHES: NEW YORK • PHILADELPHIA • BUFFALO • DETROIT • GRAND RAPIDS • INDIANAPOLIS • LOUISVILLE

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-193

NEW WENDT-SONIS TOOL HOLDER



FOR THROW-AWAY CARBIDE INSERTS

Lowers cost per cutting edge 76%

On one job, cutting edges on this new Wendt-Sonis holder cost only $0.17 each. When the cutting edge dulled, the carbide insert was unclamped and indexed to provide a new edge. When all 8 edges were dull the low cost insert was replaced. Cutting edges of brazed carbide tools formerly used, cost $0.70 each.

LOWER TOOL INVENTORY. One holder and a stock of low cost inserts will replace a stock of brazed single point tools. Inserts in a wide range of carbide grades are available for one holder. Holder can be used with or without chip breaker.

ELIMINATE DIAMOND GRINDING. Insert regrinding is unnecessary. Chip breaker grinding is eliminated as separate throw-away carbide chip breakers can be clamped on top of the insert.

SHORTEN MACHINE DOWN TIME. Inserts can be indexed or replaced without removing holder from machine. Machine resetting is often unnecessary as precision inserts can be indexed to ±.001".

Wendt-Sonis Mechanical Tool Holders are available in styles for almost any operation, right or left hand cut, and with positive, negative or neutral rakes. Carbide inserts are utility or precision ground. Write for Catalog #56. Address Dept. TE-456

WENDT-SONIS COMPANY
HANNIBAL, MISSOURI
ROGERS, ARKANSAS

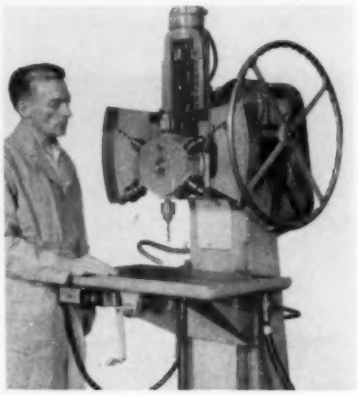
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-194

wet cutting but can be used dry.

A special adapter will set the cutting head to one side so it can be used to cut gates and risers from large castings.

Victor Engineering Corp., 15 Maple Ave., Paoli, Pa. **T-4-1941**

Turret Drill



This small, fast Burgmaster turret drill, Model 1C easily handles holes up to ⅜ in. in steel. It has a 7-in. stroke and a speed range of 325-4050 rpm. Among its features are fast power indexing, sensitive feed and preselective speeds and stops. There are no quick change tools. The units can be used to do any combination of six operations in one setup.

Burg Tool Mfg. Co., Inc., Gardena, Calif. **T-4-1942**

Bar Gages

A series of large diameter bar gages provides 0.0001-in. accuracy for inside or outside diameters as large as 36 in. They are particularly designed for quick, economical use under special inspection requirements ordinarily demanding special gages.

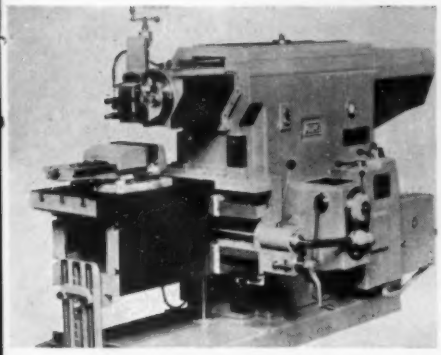
Infinite variability can be obtained between 9 and 36 in. Complete sets to provide a few sizes to cover a wide range can be developed.

Rimat Gage Co., 21 W. Dayton St., Pasadena, Calif. **T-4-1943**

Heavy Duty Shaper

This heavy duty shaper, designed especially by Schlenker & Co. of Western Germany, for use with carbide tools, features a heavy V shaped ram which slides in plastic guides to minimize wear. V shape of the cross section of the ram assures absence of any play.

Maximum stroke is 33½ in., and cross feed of the table is 31½ in. A range of



18 ram speeds allows adjustment of 6 to 108 spm. Machine table is equipped with both vertical and horizontal rapid traverse.

Distributed by Eric R. Bachmann Co., Inc., 27-11 41st Ave., Long Island City 1, N. Y. **T-4-1951**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

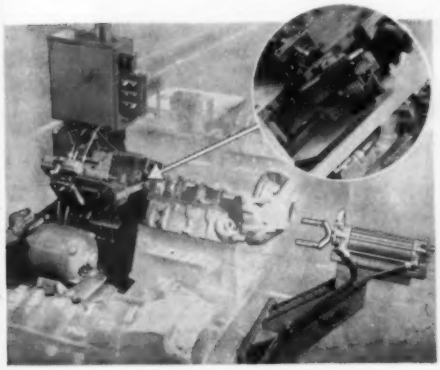
Marking Unit

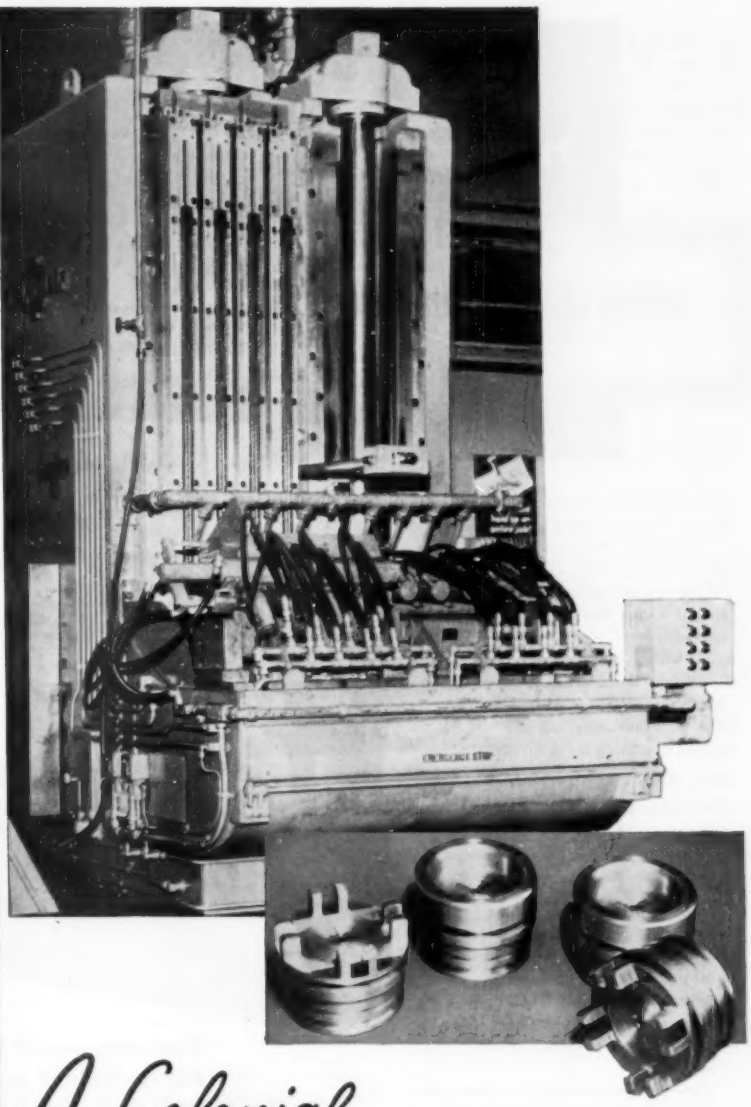
A hydraulic marking unit has been especially developed for operation on automatic production lines.

In the application illustrated the device is installed in an automobile engine assembly line. This unit begins its cycle after receiving a signal from the master control panel and also from the workpiece in the proper station. An 8-sec. work cycle consists of clamping, marking, automatic indexing of numbering head, unclamping and recording engine serial number on a continuous paper tape. It performs all these functions without the service of an operator.

The unit is designed with a universal mounting plate so that it can be installed to operate in any position.

Cadillac Stamp Co., 17315 Ryan Rd., Detroit 12, Mich. **T-4-1952**





A Colonial

UNIFIED BROACHING INSTALLATION

- 480 parts per hour
- 2 passes per part
- 90° index between passes
- Automatic broaching cycle
- 168 pounds of metal broached per hour
- Automatic chip removal
- Colonial dual ram 15-ton 66-inch stroke
- Ask for Colonial dual ram bulletin RT-54

COLONIAL BROACH & MACHINE CO. DETROIT 12, MICH.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-195

dixi 60

horizontal optical jig borer

with 5 optical microscopes

DESIGNED AND BUILT FOR:

VERSATILITY
Optical settings for operations in all planes and compound angles . . . Equally suitable for tooling, short-run or production work . . .

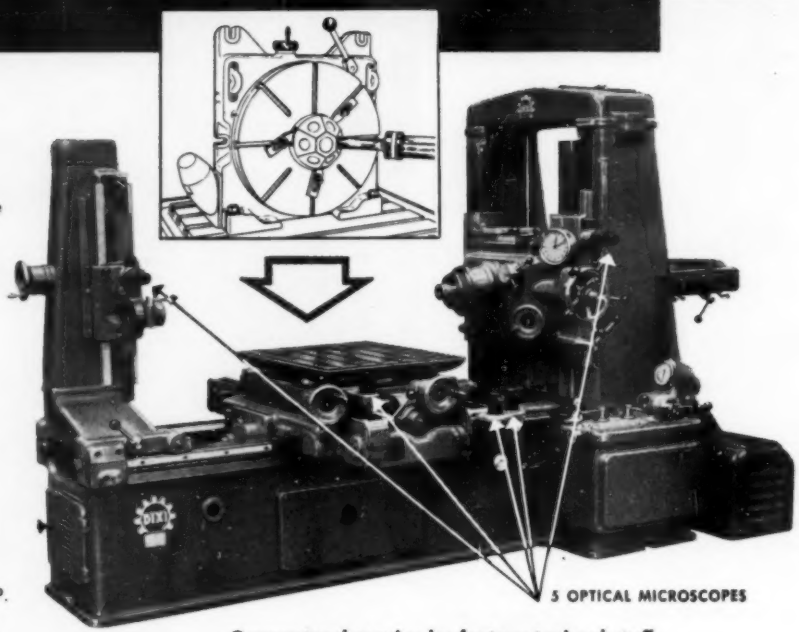
ACCURACY
Overall accuracy of .0002"

A precision machine for *JIGLESS* boring, facing, milling, and drilling work, in all planes. Built-in 360° optical rotary table, 28¾" x 32⅝". All spindle and table settings by optical microscopes. Infinitely variable hydraulic feeds. Mechanical spindle feeds with automatic depth stop. #40 taper spindle-speeds infinitely variable to 1400 R.P.M. Special features eliminate effect of spindle overhang on accuracy.

DIXI 450 PRECISION OPTICAL CIRCULAR DIVIDING TABLE

Direct readings of 1 sec.

(See insert picture above) rigidly mounted (not tilting) on built-in rotary table permits holding close tolerance relations between bores in all planes, including bores at compound angles. ALL IN ONE SET-UP. All sides of the work piece except the mounting face machined in one set-up.



- ***Guaranteed service by factory trained staff***
- ***Engineering staff available for consultation***
- ***Spare Parts in New York stock***
- ***Your operators trained***

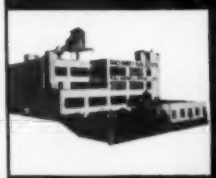
DIXI 60 now in wide use in leading Aircraft and Manufacturing Plants throughout the United States.

Names available upon request.

SEE THIS VERSATILE MACHINE IN OPERATION

at our New York or Cleveland Show Rooms. Write for Complete descriptive literature and prices to Department 21. Catalogues on additional production equipment also available on request.

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FIELD notes

Cash awards are being offered by The James F. Lincoln Arc Welding Foundation for ideas or suggestions that will accelerate progress in arc welding. Residents of the United States or its possessions are eligible to submit ideas on any aspect of arc welding that can be used to advance welded design, welding engineering or the general application of the welding process. Twenty awards totaling $20,000 are being offered; top prize is $5,000.

Complete information and rules for the program, which closes July 30, 1956, are available from the Foundation, Cleveland 17, Ohio.

V V V

Now in its 15th year of operation, Schmarje Tool and Engineering Co., manufacturers of carbide tools, has announced its change of name to Schmarje Tool Co.

new activities

Branch office and warehouse facilities for J. N. Fauver Co. have been opened at G-3140 E. Hemphill Rd. in Flint, Mich. John W. Mestrezat will be in charge of the Flint location which will service the Saginaw Valley area.

V V V

Full scale commercial production of impact extrusions for industry is under way by General Dry Batteries, Inc. The company has converted its modern plant at Memphis to this manufacturing operation.

V V V

Acme Aluminum Alloys, Inc. has completed the first phase in renovating its operations with an eye toward changing over to tool and special machinery manufacturing. Major step in the rehabilitation program has been the complete elimination of foundry operations. The relinquished area of 180,000 sq ft now is converted into working space divided among the tool division, engineering and manufacture of special machinery, pattern division, tool design, with extra space for expansion.

Production getting under way at the new forging facility of Harvey Aluminum will soon provide industry with aluminum alloy hand forgings weighing as much as two tons. In order to produce the forgings, the company is setting up a special operation in its ingot plant and installing direct chill casting equipment designed to cast ingot to a diameter 32 in. or more.

corporate changes

Assets and business of the Sterling Die Co. have been bought by Pratt & Whitney Co., Inc. and is now being operated as the Sterling Die Div. of P & W. No changes in plant location or in operating personnel are contemplated. The acquisition was completed to supplement other Pratt & Whitney and Sterling products to round out the line of thread rolling dies. Herbert T. Yankee, founder and president of Sterling continues to direct the subsidiary's operations as vice-president and general manager.

V V V

All land, factory building, machinery, inventory and patent applications of Wadell Tools at North Branch, N. J. have been acquired by Eclipse Counterbore Co. of Detroit. Production in the new addition to Eclipse is scheduled to continue uninterrupted under the supervision of Ray A. Parent who has been associated with Wadell for many years in connection with design, manufacturing and servicing. All operations of both Eclipse plants are under the management of Herbert R. White, vice-president and general manager.

V V V

Capital stock of National Precision Casting Corp. is now owned by the Beryllium Corp. According to company officials, this step represents a continuation in a long-range program to expand and diversify wherever practicable. Present management and manufacturing operations of the acquired firm are continuing as before.

Hammond Machinery Builders, Inc. have purchased the Grand Rapids line of drill and tap grinders from Gallmeyer & Livingston Co. Now orders for parts as well as new machines are being filled by the new owners.

V V V

As a result of the acquisition of all assets and patent rights of Roto-mation Motors, Inc. Pines Engineering Co. has now formed a new subsidiary to be known as Roto-Mation, Inc. The new firm will continue with the manufacture and sale of the former company's oscillating torque motors. Equipment and engineering personnel of the acquired company have been moved from St. Clair, Mich., to Greenville, Ohio, site of the new installation.

V V V

Morse Chain Co,. a Borg-Warner subsidiary, has announced acquisition of Eberhart-Denver Co. and its affiliate, the Spreco Co. According to the announcement, the move was a step in the growth and expansion program set up for Morse Chain, and will permit a rounding out and supplementing of Morse Chain's present line of products.

V V V

Shareholders of Rheem Mfg. Co. and Richmond Radiator Co. have voted to merge. Procedural requirements which will make the merger effective will be completed in late March. Under the agreement, John J. Hall, president of Richmond, will become a vice-president of Rheem in charge of a separate Richmond division.

new companies

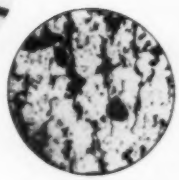
Yale Associates has been formed as a technical sales company for the purpose of furnishing manufacturers of precise or complex measuring equipment with technical field representation. Heading the new organization as president is Gordon A. Yale, who was previously president of Stocker & Yale, Inc. Mr. Yale, a registered professional engineer with extensive experience in the field, is a member of ASTE's Boston chapter.

V V V

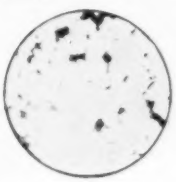
A Canadian subsidiary of F. J. Stokes Machine Co. has been established to carry on the company's growing operations in Canada. The new organization, F. J. Stokes Co. of Canada, Ltd., will be headed by Francis Dougherty, Jr., president of the present firm in Philadelphia. Headquarters is located at 27 Wellington St. East, Toronto.

select most practical coolant cleaning

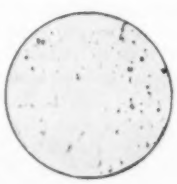




Composite swarf from wet O.D. grinder—magnified 60 diameters.



Composite steel swarf from super-finish grinder—magnified 60 diameters.



Composite honing swarf—magnified 60 diameters.

USE **BARNESDRIL** LABORATORY RESEARCH

To help you get production efficiency in the use of coolants, BarnesdriL maintains complete laboratory facilities for testing samples of contaminated coolants and other industrial fluids. From these tests, the characteristics and quantity of contaminants can easily be determined, and studied for recommendation as to the best possible method for efficient removal.

When you have coolant purification problems send them to BarnesdriL Engineers.

COOLANT BARNESDRIL CLEANING

FILTRATION DIVISION
BARNES DRILL CO.
870 CHESTNUT STREET • ROCKFORD, ILLINOIS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-198

Two new companies, Taylor Devices, Inc., a manufacturing firm, and Tayco Developments, Inc., a research company, have been formed recently to manufacture and develop compressible material devices. The companies, which are headed by Paul H. Taylor as president, are both located at 188 Main St., North Tonawanda, N. Y. Products will be marketed under the trade names of Liqui Springs and Liqui Spring Shoks.

new facilities

Precise Products Corp. is moving into a new modern plant on Blue River Rd. in Racine, Wis. The expanded facilities will allow a 100 percent production increase.

V V V

New administrative and engineering center has been completed for Vickers, Inc. in suburban Detroit. The 150,000-sq ft facility will be devoted entirely to research, development, engineering, sales and administration, with technical activities occupying the major portion of the total space.

V V V

Marvel Engineering Co. has completed the move to its new plant at 7227 N. Hamlin Ave., Chicago. In addition to providing enlarged facilities for the company's activities, the new structure is situated so as to allow for further future expansion.

V V V

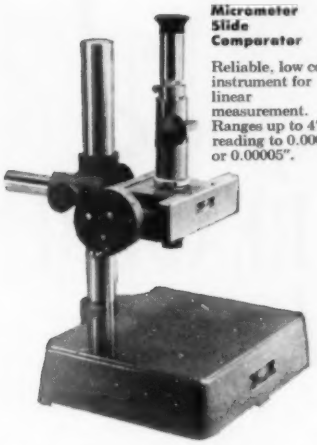
Colonial Metals Co. marked its 10th anniversary by dedicating a new, enlarged control laboratory. The laboratory features the latest wet analysis equipment plus a new Baird-Dow direct reading spectrometer.

expansions

Borg-Warner has appropriated $10,000,000 to finance a major expansion in the plastics manufacturing field. It will include erection of a modern chemical plant comprising a series of buildings at Washington, W. Va. for the development of its thermoplastic resin.

V V V

Square D Co. has earmarked $9-million for new plants and other capital improvements in an expansion program to be completed during 1956 and 1957. These plans, which include the previously announced $3-million Milwaukee plant, will provide the company with an additional 400,000 sq ft of high-production facilities. Upon completion of the program, Square D will have a



Micrometer Slide Comparator

Reliable, low cost instrument for linear measurement. Ranges up to 4", reading to 0.0001" or 0.00005".

Gaertner measuring microscopes

Easy, sure measurement to 0.0001" cuts rejects and speeds production

Precise, versatile, easy-to-use Gaertner measuring microscopes assure positive, direct measurement of precision parts. You see clear, sharply-defined images. No physical contact to distort or injure object being measured. Enjoy new production savings with Gaertner optical instrumentation. Write for complete data on the Gaertner line of industrial microscopes.



Toolmakers' Microscope

Ultimate in measuring microscopes. Range 2" x 4", reading to 0.0001", angular measurement to 1 minute.



Coordinate Measuring Microscope

High precision, low cost instrument for 2-dimensional linear measurement. Range 2" x 2", reading to 0.0001".



Filar Micrometer Microscope

High quality, low cost instrument for extremely precise measurements. Range 0.08", reading to 0.00002".

Write for Bulletin 161-54 showing applications, models, specifications.

The Gaertner Scientific Corporation

1241 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335
INDICATE A-4-199-1

network of decentralized manufacturing plants in 11 North American cities, including existing Toronto and Mexico City installations. Currently the company is beginning operations at a new manufacturing plant in Royal Oak, a Detroit suburb.

V V V

Continuing its expansion and modernization program, Selas Corp. of America has moved from its former Philadelphia site to a new million-dollar plant north of the city in Dresher, Pa. Except for the ceramics laboratory, all research and development is now concentrated in a centrally located building specifically designed for such work. The manufacturing building adjoining the laboratory, contains all production equipment as well as storage. A third building houses engineering and administrative offices and service facilities.

V V V

Manufacturing operations for Armstrong-Blum Mfg. Co. are being expanded as a result of the recent purchase of an adjoining plant. The extra facilities will immediately almost double the company's manufacturing floor space while also increasing office, laboratory and research areas.

anniversaries

Centennial anniversary of its founding is being celebrated this year by Whiton Machine Co. The firm, now of New London, was established in 1856 as the D. E. Whiton Machine Co. in West Stafford, Conn.

V V V

Commemorating its 100 years of manufacturing of refractory products, Robinson Clay Products Co. is planning a special program designed to accent a "century of progress." The program, which will include salutes from organizations such as the U. S. Chamber of Commerce, Ohio Chamber of Commerce, and the National Association of Manufacturers, will follow the company's growth from the original Summit Pottery Works to the present organization which operates plants in eight locations in Pennsylvania and Ohio.

V V V

Noble & Westbrook Mfg. Co. marks its 50th anniversary this year in the metal marking equipment field. Among the company's achievements have been dial type rapid production marking machines, automatic installations, and most recently Cyclomatic control for cycling and sequencing.

AIR-HYDRAULICS

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MORE STROKES / CU. FT. AIR / MINUTE

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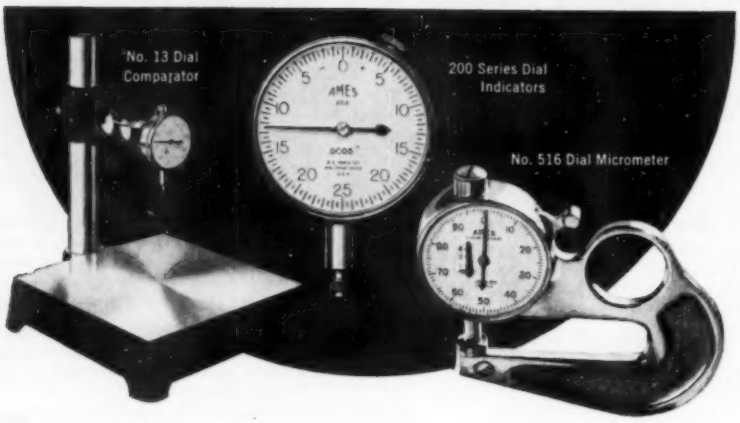
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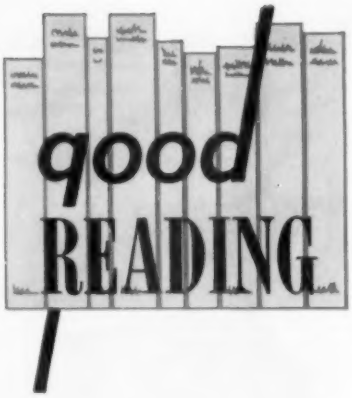
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COMPRESSED AIR HANDBOOK, 2nd Edition,—*by the Compressed Air and Gas Institutte. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St. Price $8. 383 pages.*

This comprehensive guidebook gives description, data, and pointers for best results in using air power in a wide variety of industries. This second edition includes an additional section on installing, using, and operating centrifugal compressors and extra data on uses for compressed air power, displacement type compressors, and compressor installation techniques.

Also the approved terminology for describing compressed air machinery and parts is included.

BUSINESS, LEGAL, AND ETHICAL PHASES OF ENGINEERING, *By D. T. Canfield and J. H. Bowman. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $6.50. 365 pages.*

Although this book is intended primarily as a textbook in engineering economics for college seniors, many tool engineers may find it a useful reference work. Part I, Business Economy, covers the types of business organizations, stocks, bonds and notes, money, interest and discount, annuities and sinking funds, insurance, bond interest and amortization, depreciation, maintenance and replacement, and economic selection.

Part II, Cost Determination, discusses distribution factors, financial reports and records, allocation of burden, and public utility rates. Part III, Business Law, includes material on contracts, agency, negotiable instruments and sales and sales agreements. Part IV, Engineering Procedures, has chapters on engineering bids and specifications, patents, copyrights and trade marks, insurance, industrial hazards and employment compensation, the practice of engineering, and engineering as a profession.

BRAZING MANUAL, *Prepared by the Committee on Brazing and Soldering, American Welding Society. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $4.75. 193 pages.*

This manual is a complete handbook of brazing, covering brazing processes, equipment and procedures, the properties of base metals and brazing filler materials, fluxes and atmospheres, precleaning and surface preparation, and assembly. The various techniques of brazing are discussed in detail, as are postbraze operations and inspection methods. Separate chapters are devoted to drafting practices, joint design, safety and health protection, and to the application of brazing processes to a wide range of ferrous and nonferrous metals.

METALLURGICAL PROGRESS—2, *By Drs. J. M. McLeod, D. D. Howat and H. B. Bell. Published by Philosophical Library Inc., 15 E. 40th St., New York 16, N. Y. Price $6.00. 71 pages.*

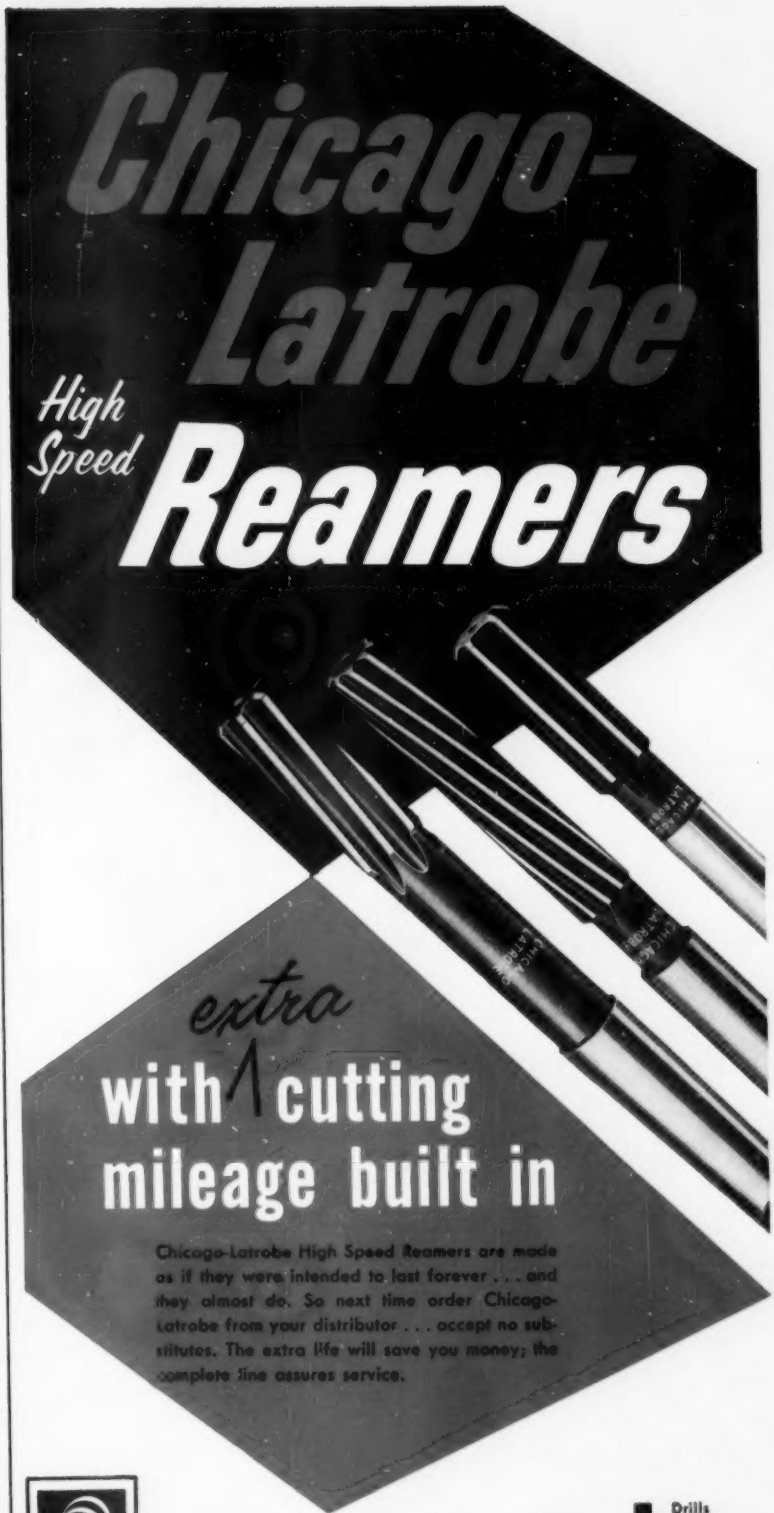
Three members of the staff of the Royal Technical College, Glasgow, summarize the results of research work in their fields over the past 30 years. The section on preparation of ores, by Dr. McLeod, discusses methods of improvement of blast furnace burdens, the sintering of iron ores, theory of sintering and testing of materials, methods of agglomerating fines other than sintering and direct smelting processes.

The section on electric steel production, written by Dr. Howat, covers sulphur and hydrogen removal, chromium in electric furnace steel, and the use of oxygen in the electric arc furnace.

A third section of the book, prepared by Dr. Bell, deals with non-metallic inclusions. Deoxidation products and sulphides, nitrides and exogenous types of inclusions are discussed and material on the microscopic examination of inclusions is given. Information in the book is supported by numerous bibliographical references.

ENGINEERING CYBERNETICS, *By H. S. Tsien. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $6.50. 289 pages.*

Cybernetics has been defined as "the science of organization of mechanical and electrical components for stability and purposeful actions." This book stresses the fundamental concepts of engineering cybernetics as an engineering science, rather than the application of the principles of cybernetics to specific types of servomechanisms or similar devices. The treatment of the subject is entirely theoretical and mathematical and is written for specialists in the field.



technical Shorts

INDUSTRY CAN DETERMINE for itself how chromium diffusion can be used economically in their manufacturing operations through new test kits. The laboratory kit contains instructions and various materials required to diffuse chromium into small pieces of ordinary steel and give them the surface characteristics of stainless steel. The process is offered by Alloy Surfaces Co. of Philadelphia, Pa. The tests will indicate whether or not chromium in steel for the company's products will lower cost, resist corrosion under severe atmospheric, water and chemical corrosion conditions, resist thermal oxidation at temperatures to 1600 F and resist wear and abrasion under difficult applications.

Lab Kits For Steel Experiments

The stainless surface alloys will not chip, crack, peel or gall even when a low carbon steel processed product is bent 180 deg, stretched or twisted. The process will not cause appreciable dimensional changes other than those inherent to the normal heat treatment of the parent metal. After processing, products can be heat treated in the normal manner and they can be brazed, arc welded or spot welded.

Firms which decide that the chromium diffusion process is desirable, may obtain one of two types of license arrangements. One of these types is for original equipment manufacturers, while the other is for contract processing plants. Three processes are available, each tailored to a particular range of steel. The same operating procedures used with the kits are used in actual production. Write Alloy Surfaces Co., 1115 N. 38th St., Philadelphia 4, Pa. for more technical information.

* * *

NOW BEING PRODUCED on a pilot plant operation, a new inorganic construction material called Kanamite is scheduled for commercial production soon by Ferro Corp. According to the fabricators, initial production will be for use in casting resins in electronic equipment, as a core filler in plastic dies, and as a strength additive in foamed plastics. Basically, the substance is a unicellular, spheroidized clay particles fired at about 3,000 F in a special process developed by Armour Research Foundation for Kanium Corp.

Inorganic Substance For Casting Use

* * *

FACING THE POSSIBILITIES (remote or not) that an emergency could quickly curtail use of nickel, has fostered development of an aluminum casting alloy which is relatively unaffected by nickel shortages. The new alloy, F132, was primarily developed by Aluminum Co. of America to replace its earlier D132 which had a higher nickel content. Properties of the two materials, however, are virtually identical. Their growth and expansion characteristics show no significant difference, and there seems no apparent dissimilarity in the casting characteristics of the two alloys. Factors such as surface quality and internal soundness and machinability of parts made from the materials appear also to remain unchanged.

Introduce Low-Nickel Aluminum

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J & L's new Taper Receding Die Head is *full* receding. Only the chamfered teeth and the first full tooth in the chaser set do the cutting. Pressures on the chasers are much less than those resulting from "form" or "jam" cuts. And cutting action is the same as that of straight threading. You get smoother threads — no "leave-off" lines — longer chaser life.
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A-4-20	Allegheny Ludlum Steel Corp.	Tool Steels—Folder contains data on forging, annealing, tempering and detailed laboratory data on physical characteristics of Ludlum Deward and Ontario steels. (Page 20)
A-4-58	American Broach & Machine Co.	Broaching Machine—"American" catalog 450 contains data on broaching operations. (Page 58)
A-4-13	American Drill Bushing Co.	Drill Bushings—Operational data contained in catalog (Page 13)
A-4-12	The American Tool Works Co.	Duplicating Lathes—Bulletin No. 35 contains data on American duplicating lathes. (Page 12)
A-4-200	B. C. Ames Co.	Indicators—Catalog contains data on the Ames line of dial indicators. (Page 200)
A-4-164	Armstrong Bros. Tool Co.	Tool Holders—Catalog contains data on tool holders and carbide inserts. (Page 164)
A-4-41	Axelson Manufacturing Co. Div. of U. S. Industries, Inc.	Milling Machines—Catalog contains data on twin-head Axelson milling machines. (Page 41)
A-4-169	Baker Brothers, Inc.	Special Machines—Catalog contains information on Baker Basic machines. (Page 169)
A-4-16	W. F. & John Barnes	Engineering—Information on special Barnes automation service. (Page 16)
A-4-294	The Bellows Co.	Air Motors—Bulletin ML-3 gives data on the Air Motor and Hydro-Check combination. (Page 294)
A-4-250	Brush Electronics Co.	Surfindicator—New booklet contains data on Brush surfindicator including the new ASA standards. (Page 250)
A-4-285	Cadillac Gage Company	Gages—Catalog contains information on Cadillac Pla-Chek gage lines. (Page 285)
A-4-207	Campbell Machine Division American Chain & Cable Co.	CutOff Machines—Information on abrasive cut-off machines contained in catalog. (Page 207)
A-4-280-2	Chicago Rivet & Machine Co.	Rivet Setter—Catalog contains engineering information and rivet specifications. (Page 280)
A-4-33	Cincinnati Shaper Co.	Shear—All steel shear with a 36" gap and a 48" back gauge range described in catalog S-7. (Pages 32-33)
A-4-15	Cone Automatic Machine Co.	Special Machines—"Four Steps with Cone" contains particulars of Conomatic operations. (Page 15)
A-4-175	Cosa Corp.	Die Sinkers—Bulletin contains information on automation in die sinking. (Page 175)
A-4-241	Crane Packing Co.	Surface Finish—Free booklets contain facts on producing and measuring precision flatness and finish. (Page 241)
A-4-29	Danly Machine Specialties Co.	Die Set Data—200 pages of die set data available in new Danly catalog. (Page 29)
A-4-278-1	Detroit Stamping Co.	Toggle Clamps—Free literature on the De-Sta-Co titan models 557, 558. (Page 278)
A-4-54	DeVlieg Machine Co.	Special Machines—Illustrated catalog contains information on the DeVlieg line of machines. (Page 54)
A-4-44	The DoAll Company	Band Saws—Handbooks available on "Power Sawing" and "Band Tool Manual." (Page 44)
A-4-206-1	The Eastern Machine Screw Corp.	"Unified and American Screw Thread Digest" sent upon request. (Page 206)
A-4-225	Eastman Kodak Co.	Cameras—Details and case histories of industrial cameras. (Page 225)
A-4-63	Federal Products Corp.	Air Gages—Facts and figures concerning dimensional air gages. (Page 63)
A-4-192	William H. Field Co., Inc.	Grinders—Copy of new Centra-Point Data Sheet available. (Page 192)
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A-4-182	Lepel High Frequency Laboratories	Induction Heating—Information on Lepel products contained in the illustrated 26-page catalog. (Page 182)
A-4-165	Lincoln Gage Co.	Gages—20-page catalog illustrates and describes Lincoln Gages. (Page 165)
A-4-263	Logansport Machine Co., Inc.	Cylinders—New "Ultra-matic" Cylinder Catalog" No. 100, Section 5-1 available. (Page 263)
A-4-280-1	Lovejoy Tool Co.	Special Cutters—Catalog No. 31 contains information on face mills, No. 32 on side mills, No. 33 on arbors. (Page 280)
A-4-65	Madison Mfg. Co.	Machine Tools—Literature available on the Madison line of tools used in the metalworking field. (Pages 64-65)
A-4-278-3	W. F. Meyers Co., Inc.	Drill Bushings—Catalog 62 contains information on Meyco carbide inserted drill jig bushings. (Page 278)
A-4-187	Oakite Products, Inc.	Metal Cleaning—Information about the electrocleaning of steel, brass or zinc die castings available in booklet form. (Page 187)
A-4-70	The Ohio Crankshaft Co.	Induction Hardening—"Typical Results of TOCCO Induction Hardening and Heat Treating" available in catalog form. (Page 70)
A-4-212-2	O'Neil-Irwin Mfg. Co.	Precision Bending—32-page catalog gives information on Di-Acro hydra-power and hand benders. (Page 212)
A-4-183-2	Ortman-Miller Machine Co.	Cylinders—Bulletins 101A and 105 contain data on air and hydraulic cylinders. (Page 183)
A-4-57	R and L Tools	Tools and Holders—New catalog available describing the R and L line. (Page 57)
A-4-264	Richard Brothers Punch Division, Allied Products Corp.	Retainer Plates—Information on R-B retainer plates, punches and dies contained in catalog. (Page 264)
A-4-281	The Rotor Tool Co.	Air Tool—Bulletin 46 contains operational data on the Rotor Tool line. (Page 281)
A-4-288-1	Anton Smit & Co., Inc.	Diamond Tools—Information available on the use of diamonds in manufacturing operations. (Page 288)
A-4-193	Standard Die Set Mfrs., Inc.	Die Set—Comparison chart, die set catalog, and sample die makers' grease available upon request. (Page 193)
A-4-49	The L. S. Starrett Co.	Dial Indicators—Information available on Starrett high-precision low-friction dial indicators. (Page 49)
A-4-67	Stupakoff Division, Carborundum Co.	Cutting Tools—Bulletin gives physical, mechanical properties and operating data on Stupalox tools. (Page 67)
A-4-218	Sutton Tool Co.	Collets—28-page catalog contains data on collets, tool chuck jaws and work-holding devices. (Page 218)
A-4-174-1	Syntron Co.	Parts Feeders—Catalog contains data on automatic feeding and orientation of small parts. (Page 174)
A-4-168	Tracer Control Co.	Tracer Control—Catalog contains data on tracer control duplimatic. (Page 168)
A-4-173	Waldes Kohinoor, Inc.	Grooving Tool—20-page technical manual on the Waldes Truarc Grooving Tool. (Page 173)
A-4-194	Wendt-Sonis Co.	Tool Holder—Catalog No. 56 contains data on Wendt-Sonis tool holder for throw-away carbide inserts. (Page 194)
A-4-226	Wiedemann Machine Co.	Presses—Bulletin 101 contains data on Wiedemann Turret Punch Presses. (Page 226)
A-4-183-1	Willey's Carbide Tool Co.	Carbide Tools—Catalogs contain data on tungsten carbide tools used for modern automation. (Page 183)

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abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

Jig-Boring Mathematics

An article in the December 1955 issue of *Werkstatt und Betrieb* by K. Kubbe presents a number of derivations of formulas for tolerances required in jig-boring operations. In the first part of the paper the author considers several cases where holes are located on a straight line while the second part deals with holes located on a circle. He takes into consideration the size of the hole and of the plug and their tolerances. He derives the relationship for the simple case where one plug and one hole must match. A second case refers to two plugs and two holes, a third case to three plugs and three holes and eventually he comes to the generalized case of n plugs and n holes. A nomogram is presented from which the required relationship can readily be seen.

For holes located on a circle the author considers the cases where the diameter of the holes and their tolerances must be determined to permit assembly with a circular plate having a number of plugs equal to the number of holes. The dimensions and tolerances are to be so selected that the parts need no additional machining or finishing operation on the assembly line. These cases involve mathematical relationships more complicated than for straight-line location of plugs and holes. The author, however, presents a second nomogram which can be used for determining the diameter of the holes for plugs located on a circle.

Machining of Light Metals

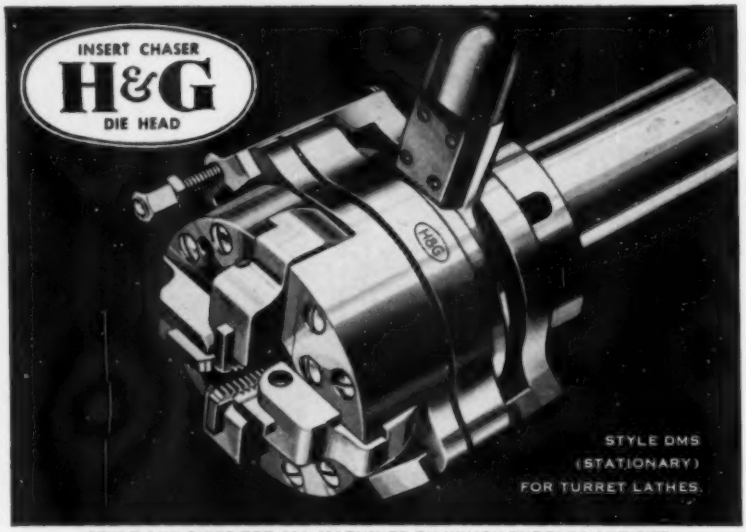
A survey of machining practice and research of light metals carried out in France by J. J. Desherault is published in Issue 7, 1955 of the magazine *Industrielle Organisation*. Freedom from vibration of machine tools is among the important conditions, according to the author, for successful machining of aluminum and other light metals. Only the higher spindle speeds are needed on the machine tools but it



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THERE IS NO OTHER LIKE IT

It cuts threads with insert chasers. These are, in reality, small sections of the business end of large and expensive chasers, but with this important difference: *their cost is so low they can be even thrown away when dull.* For example, for less than $40 you can get a dozen sets of insert chasers, each set ground ready to go. Change now to insert chaser die heads and watch your performance improve. "UNIFIED AND AMERICAN SCREW THREAD DIGEST" sent free on request.

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is necessary to have brakes available for rapidly stopping the machines.

The author has run tests on a light metal composed of an aluminum-zinc-magnesium alloy (Al-5-Zn-Mg) of 80 Brinell with tools made of high-speed steels and of cemented carbides.

The kilowatt (or horsepower) consumption dropped considerably by increasing true rake of the tool. The surface finish improved with increasing cutting speed. The author differentiates between three "factors of disturbance" in chip formation, namely, chip compression, built-up edge and poor chip removal. All three tend to damage the tool. He has found that chip compression and built-up edge are reduced when the true rake is increased at constant cutting speed and when the cutting speed is increased at constant true rake. High cutting speeds and large true rakes are therefore recommended.

Coolants are useful only when applied in proper quantities and when the oil is selected in accordance with cooling and lubrication effect. The author quotes a case where an Al-Cu-Mg alloy was face-milled at about 10,000-fpm surface speed. Only a small amount of coolant was efficient because a large amount was removed by the centrifugal force. An oil film on the tool face prevented built-up edge.

The article further deals with reamers, drills, special milling cutters, taps, band saws, circular saws and boring.

Tool Engineering in Switzerland

Twenty-five years have elapsed since the opening of the institute for shop management at the Swiss Institute of Technology according to two special editions of the magazine *Industrielle Organisation*, which is edited by the Institute. Numerous articles in these two volumes convey the idea of the education which a Swiss engineer receives who is planning to enter a career in tool engineering and scientific management. Originally based on F. W. Taylor's basic research in metal cutting and scientific management, the Institute has branched out into numerous fields such as psychology, physiology, training, work technique, human relationships as indicated by the chapter "Man."

Another chapter, "Technique," deals with tools, machine tools, shops, producing, designing, planning, methods and similar objects. An article by F. Weinberg, "Application of Probability in Industry," describes methods for rate setting on probability basis. Another article by H. Baer is concerned with the scientific tools for the research man, namely, classification and organization of research projects, including punch card index systems. Among the other articles of this chapter, one by F.

Kesselring is of interest. It covers the fundamentals of economical design using scientific methods for determining the best utilization of the material and similar items. Another article, by A. Linder, deals with planning research work. "Mechanization Takes Command," by Esther N. Baer covers the problem of rationalization in home and kitchen, on a somewhat satirical basis.

The third chapter refers to the "economy" and production control, rentability, investment, in terms of engineering science. The fourth chapter applies to "Organization" and contains articles on managers, management, coordination of men, engineering and economy. Uncertainty is often found among the men in the shop, according to the author, and can be reduced or eliminated under certain conditions. The other volume tells about studies, operation research, and the cooperation between the Institute and industry of Switzerland.

Drilling Investigations

E. van Emden has carried out drilling tests at the Delft Institute of Technology (Holland), which are described in Vol. 4, 1955, pages 183-197 of *Microtechnic*. The tests were concerned with comparison of performance of twist drills made in Holland, Germany and England. Drill point and surface roughness testers were used. No difference was found at the land and the point of the drills. The investigation revealed, however, that the drilling efficiency could be improved.

Safety Regulations

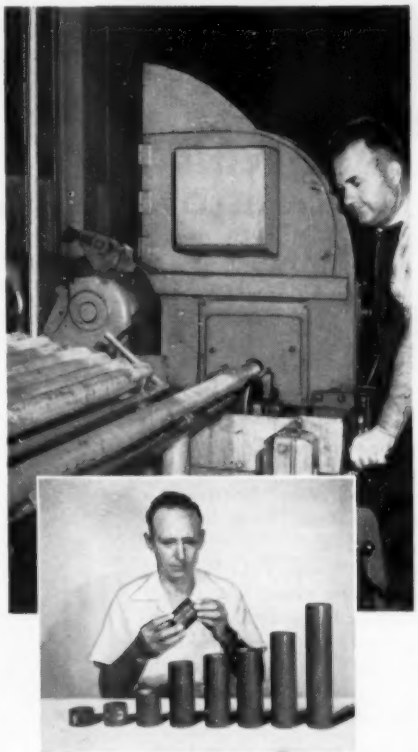
New safety regulations have been issued in Germany for grinding according to a report in *Kompass* 1955 Vol. 65 (10) page 106. They contain recommendations for permissible highest speeds, storing, protection hoods, clamping, truing, etc. The grinding wheel must be kept circular during operation by truing, while noncircular bodies must be protected. Grinding machines with electromechanical chucks must have protection against throwing off workpieces in cases of failure of the current or weakening of the field.

Ultrasonic Machining

Investigations in the field of ultrasonic machining at Tokyo University are reported by G. Nishimura, Y. Jimbo, and S. Shimakawa in the university faculty engineering journal 1955 Vol. 24 (3) pages 66-100. They found water to be a suitable lubricant and concluded that the machining action is the result of three processes, namely, collision of abrasive particles with the workpiece, chipping action of the abrasive, and cavitation. Free circulation of abrasive at the machined surface is essential.

Abrasive Cutting | *the best way to cut many materials* *the only way to cut some*

Campbell Cut-Off Machines



- Cutting 20-foot tubes of stainless steel into 1″ to 17″ lengths
- Tube lengths cut accurate to .002″

Slice $32,000 a year from tube cutting costs

• Because CAMPBELL Abrasive Cut-Off Machines not only cut stainless steel tubes twice as fast as former methods—but the clean cut saves a deburring process—Ryan Aeronautical Company saved $32,000 the first year of its operation.

Ryan uses thousands of pieces of this stainless steel tubing each month in ball-and-socket joints, nipples and sleeves of exhaust systems. They must be precision-cut from 20-foot pipe in lengths from 1 to 17 inches.

The smooth-finish cut of the CAMPBELL Oscillating Wet Abrasive Cut-Off Machine is accurate within .002″—with no hard spots, no change in metallurgical characteristics. It results from the WET cut with abundant coolant supplied just where it will do the most good. Speed and economy come from the OSCILLATION of the abrasive wheel . . . the right one for the job.

Some additional performance figures

Smooth cutting on CAMPBELL Oscillating Wet Abrasive Cut-Off Machine saves an extra grinding operation on gear tooth samples cut for metallurgical study.

International Nickel's tough K Monel, 4¾″ dia., is cut in 2 minutes per cut on a CAMPBELL Oscillating Wet Abrasive Cut-Off Machine.

How to get expert advice on your cutting problems

• CAMPBELL Engineering Service costs you nothing—can save you much. Does your metal cutting problem involve cutting of alloy or high carbon steel? Our Field Engineers are abrasive cutting specialists. They can help you arrive at just the right combination of a CAMPBELL Cut-Off Machine and ALLISON Cutting Wheel that will improve your operation and save you money.



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IT'S QUIET ON THE MEZZANINE ...WHILE THE MEN BELOW

rivet

...NOT 15 FEET AWAY!

This is a riveting line at the Irving Subway Grating Co., Long Island City, New York. *Yet you cannot hear the riveting!* Why? Because it's done with Hannifin "Hy-Power," the modern cold-squeeze riveting method.

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HOW TO REDUCE YOUR RIVETING COSTS

Do it the "silent squeeze" way with Hannifin portable and stationary yoke riveters which are available in capacities from 7½ to 100 tons (more in multiple). It's a fast method. It's a method that assures complete uniformity of every rivet. It's a safe method; for while a touch of a button starts the ram, the stroke may be interrupted and the ram reversed at any point in the cycle, simply by releasing the control button.

See your Hannifin representative who will demonstrate why "Hy-Power" riveting and punching equipment has a place in your production picture. Hannifin Corporation, 1101 S. Kilbourn Ave., Chicago 24, Illinois.

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Men at Work

Donald L. Rheem was recently elected chairman of the board of Rheem Mfg. Co. A co-founder of the company, Mr. Rheem was previously executive vice-president of the company.

At the same time, the board of directors elected **A. L. Walker** as executive president. He also will continue to serve as vice-president in charge of Rheem International.

Also announced was the appointment of **Emerson S. Ronk,** former management consultant executive, to the newly created post of vice-president of administration.

At the recent meeting of the stockholders of E & E Engineering, Inc., **Wood M. Geist** was elected vice-president of the company.

Erich Gobien has been appointed general methods engineer at Kurt Orban Co., Inc. In this capacity he will supervise installation of Orban equipment and train plant personnel in setting up, operating and servicing techniques.

W. Sheridan Huss is new president of Acme Steel Products Div. of Acme Steel Co. He formerly was vice-president and general sales manager. He succeeds **John G. Bucuss** who retired. Mr. Bucuss will continue with the company in an advisory capacity.

William W. Dickhart, III, is new chief of machine design and development section of The Franklin Institute Laboratories. He has been a member of the Laboratories' engineering mechanics section, engaged in designing, analyzing or trouble shooting, and testing machine for various clients.

Ralph R. Brown has been appointed works manager of Selas Corp. of America. He joins Selas after serving as vice-president and manager of manufacturing at Macon Arms, Inc.

At the same time the company announced promotion of **Ernst A. Siemssen** to superintendent of erection. He has been performing special assignments in connection with engineering and construction.

Frank W. Zurn was named vice-president-manufacturing of J. A. Zurn Mfg. Co. and its subsidiary companies. He formerly was manager of sales for the mechanical power transmission products division.

Another management change announced by Zurn was the appointment of **Paul I. Benton** to the post of plant manager in charge of production and personnel relations. He has been associated with the firm for 10 years in various manufacturing capacities.

George Perrault, Jr., manager of the Salem, Ohio, Rolling Mill Div. of E. W. Bliss Co., has been made a vice-president of the company. He first joined the firm in 1949, and was appointed manager of the division in 1954.

Appointment of **Judson B. Schoonover** as project manager of receiving and receiving inspection departments has been announced by the IBM plant in Endicott, N. Y. Mr. Schoonover is a member of ASTE's Binghamton chapter.

Myron B. Diggin was named vice-president and a director of Hanson-Van Winkle-Munning Co. A veteran of 25 years with the firm, he has been its technical director and also assistant vice-president. Recently his work has been on electrochemical processes.



Paul W. Polk was appointed executive vice-president of The Sheffield Corp. to succeed John P. Bernard. Mr. Polk, who has been vice-president of Sheffield and general manager of its subsidiary Threadwell Tap and Die Co., belongs to ASTE's Springfield, Mass., chapter.



Robert C. McDowell has been elected president of The Wellman Engineering Co., succeeding Dr. J. C. Hodge who resigned. Mr. McDowell, who also is the president of McDowell Co., Inc., will now serve as board chairman and president of Wellman Engineering.



William J. Loach was recently elected to the office of executive vice-president of Firth-Loach Metals, Inc. Mr. Loach, who was a co-founder of the firm, previously served as its vice-president and general manager. He is a member of ASTE's Pittsburgh chapter.



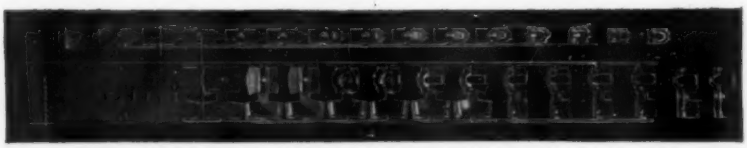
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60 caliber single and double loop links . . . produced by the millions — and hundreds of millions — and all must be absolutely identical, accurate! These stringent specifications demand the finest dies and diemakers — that's why B. Jahn was selected. The master toolmakers and engineers at B. Jahn built a 13 station and 16 station progressive die that formed the intricate components from heavy SAE — 1055 steel. Million plus runs . . . precise fidelity . . . and lasting economy . . . were engineered into every die — and verified by "production proving" in the B. Jahn plant before delivery. Whatever your product, your problem — B. Jahn die making ingenuity can help you deliver better goods . . . in less time . . . at less cost.



Die ribbons showing 13 and 16 stations necessary in producing tremendous runs of shell loop links!



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Elmer B. Dunkak has been elected to fill the recently created position of vice-president-sales at Selas Corp. of America. Prior to joining Selas, Mr. Dunkak was engaged in private engineering practice.

The newly created post of works manager for La Salle Steel Co. has been filled with the appointment of **George W. Evens.** He now assumes many of the responsibilities previously held by the late Theodore S. See who was vice-president in charge of operations. Mr. Evens was general superintendent of the La Salle plant for 27 years.

Clifford R. Kral was named production manager of the machine division of The Torrington Mfg. Co. Associated with the firm since 1946, he has been planning manager for the division.

Colonial Metals Co. has announced appointment of **Fred E. Solymos** as vice-president and general sales manager. He has been associated with the nonferrous metals field in this country for many years.

E. J. Skramstad was recently elected president of the Small Lot Metal Stamping Institute. Mr. Skramstad, who also is a member of ASTE's Twin Cities chapter, is associated with the Federal Tool & Mfg. Co.

Election of **James G. Tuthill** to the office of president has been announced by Tuthill Pump Co. Mr. Tuthill, who joined the firm in 1953, was made vice-president in April of last year. He now succeeds **H. T. Kessler** who retired.

Clearing Machine Corp. has announced appointment of **David D. Wallace** as a vice-president. Mr. Wallace, who has been a Clearing executive for more than 12 years, was formerly assistant to the president.

New supervisor of quality control for Acme Steel Co. is **Alfred M. Goodman** who until recently was supervising metallurgist at Inland Steel Co.

Progressive Welder Sales Co. has announced appointment of **William T. Wilbur** as chief application engineer. Until recently he had his own special machine and product design company which handled resistance welding machine design.

William T. Ritchie has been named general foreman of the Machinery Div. of Pratt & Whitney Co., Inc. A veteran of 15 years with the company, Mr. Ritchie was formerly head of its milling department. In that capacity he is succeeded by Dominic Ricardo.

TRADE literature

For Free Booklets and Catalogs — Convenient Request Card on Page 203

Cutting Tools

Complete line of drills, reamers, counterbores, countersinks plus special tools presented in 52-page condensed Catalog #55; includes prices and dimensions and also technical data on tools made of high-speed, carbon steel and carbide and for use in steel, wood, concrete and glass. Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. **L-4-1**

Milling

Circular "The Sundstrand C1 Rigidmil . . . For Milling Small Parts" describes equipment, points out features and advantages, outlines various applications. Sundstrand Machine Tool Co., Rockford, Ill. **L-4-2**

Grinding Fixture

Illustrated folder discusses special features of company's Grind-All fixture and also shows it in various applications. Harig Mfg. Corp., 5751 W. Howard St., Chicago 31, Ill. **L-4-3**

Comparator Gages

Varied line of all-purpose comparator gages for use in gaging external dimensions of parts described in extensively illustrated 4-page Bulletin 200; includes specifications for various models. Metron Instrument Co., 432 Lincoln St., Denver 3, Colo. **L-4-4**

Hand Tools

Nine new hand tools, including compound leverage shears, straight snips and combination snips, plus variety of other tools presented in illustrated Bulletin 78 which gives specifications and outlines uses. Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N. Y. **L-4-5**

Brazing Aluminum

Practical shop data plus latest developments in brazing aluminum presented in 134-page illustrated book, "Brazing Alcoa Aluminum;" includes history of brazing, explanation of phenomenon which occurs during operation, describes brazing materials, and points out various considerations involved in designing, preparing and assembling brazed joints. Request only on company letterhead directly from Aluminum Co. of America, 774 Alcoa Bldg., Pittsburgh 19, Pa.

Nickel Plating

Illustrated 20-page instruction manual on bright nickel plating by the Nickel-Lume process covers three techniques; explains proper bath preparations for the processes and discusses solution maintenance, purification, handling of equipment and materials. Hanson-Van Winkel-Munning Co., Matawan, N. J. **L-4-6**

Solvent Detergents

Cleaning uses and abilities of solvent detergents discussed in revised 16-page illustrated booklet; also covers in detail methods of application, including procedures and solution concentration, and equipment used for application. Request on company letterhead directly from Oakite Products, Inc., 158 Rector St., New York 6, N. Y.

Efficiency in Cutting-off is Important

Practically all machining operations start with pieces cut-off from bars or billets. Hence, inefficiency, or lack of capacity, in the cut-off department can hold up or stagnate the entire plant.

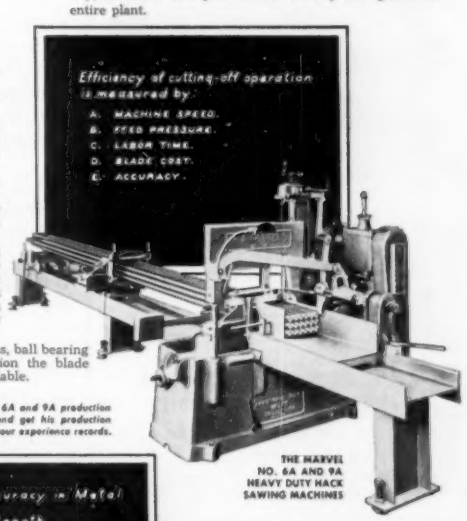
A. Are all-ball-bearing and provide a quick return; therefore they run FASTER than others on the same work.

B. Can apply as much as 1200 pounds feed pressure—two to ten times as much as other hack saws and band saws.

C. Are fully automatic, requiring no more operator attention than an automatic screw machine; and set-up for any bar size and cut-off length is extremely simple.

D. Use a non-breakable high speed hack-saw blade — the type of saw blade that produces the greatest number of square inches of metal cut per dollar of blade cost—two to ten times (or more) as much as any band saw.

E. Because of their exceptional sturdiness, ball bearing reciprocating frame, ability to tension the blade "truly taut", their accuracy is dependable.



THE MARVEL NO. 6A AND 9A HEAVY DUTY HACK SAWING MACHINES

If you are not using modern, improved MARVEL NO. 6A and 9A production hack saws, call the local MARVEL Field Engineer and get his production and cost estimates on your work—to compare with your experience records.



The composite MARVEL High-Speed-Edge Hack Saw Blade—cuts **any** machinable material efficiently. There is no time lost changing blades for different types of steel; no time lost replacing shattered blades, because MARVEL High-Speed-Edge Hack Saw Blades are positively **unbreakable.** These superior blades have the finest high speed steel cutting edge welded to a strong alloy steel body. They will stand-up under the highest speeds and heaviest feeds attainable on any make hack saw. Can be safely tensioned tauter than any other blade—cut-off not only straight but also square and with less stock loss.

Write for catalog C-55—showing and describing eleven different series of Metal-Cutting Sawing Machines and MARVEL High-Speed-Edge Hack Saw Blades and Hole Saws.

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TIME-SAVING
INSTRUMENTS
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MICRO-ALIGNMENT TELESCOPE

Zero-focusing—for alignment of all points at any distance; increased micrometer range, improved focusing drum for quick, convenient finding, improved auto-reflection and auto-collimation equipment for precise squareness setting.

New!



MICROPTIC LEVEL

B131A MARK III

Improved optics, fully kynematic mount for protected precision bubble, tested to .002" in 100 ft., the universal optical tooling level.

A COMPLETE RANGE OF PROVEN EQUIPMENT

PRECISION AUTO-COLLIMATORS for all engineering applications.

CLINOMETERS (angle gages) and PRECISION LEVELS.

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MEASURING MACHINES—all types.

UNIVERSAL MICROSCOPES for all shop inspection and production uses.

PRECISION SCALES—linear and circular—glass and metal.

Write for complete information on any of these instruments to Dept. *T-456*

ENGIS EQUIPMENT CO.

431 S. Dearborn St., Chicago 5, Ill.

INDICATE A-4-212-1

Miniaturization

Twenty-page brochure deals with approach to miniaturization as it concerns size and weight reduction in end products, thereby providing more function, service or convenience to the user. Illustrated with charts and photos, it shows importance of laboratory information on physical strength and probable loads as a prerequisite to using smallest parts. Request only on company letterhead, giving position or title, to A. W. Scott, Adv. Mgr., Standard Pressed Steel Co., Box 786, Jenkintown, Pa.

Boring, Cutting

General Catalog BT55 offers information on line of boring bars, cutters and blocks; illustrated with photos and drawings, includes data on construction, tables of specifications and dimensions, outline of uses. Lehmann Boring Tool Div. of Fulton Iron Works, 4389 Duncan Ave., St. Louis 10, Mo. **L-4-7**

Magnetic Separator

Data sheet explains company's recently developed principle of magnetic separation which utilizes a flat magnetic field rather than a drum; outlines features and advantages. Illustrated by drawings and photos. Dept. MS-298, Industrial Filtration Co., Lebanon, Ind. **L-4-8**

Marking Dies

Informative manual on marking with steel dies includes section dealing with basic information on use and selection for various applications, section on steel stamping, embossing and foil leaf marking dies; press-style type and toolpost holders for marking around peripheries of cylindrical or round-tapered parts and numbering heads for embossing or debossing. "Supplement B-146 . . . Press Style Marking Dies by Matthews." Jas. H. Matthews & Co., 3942 Forbes St., Pittsburgh 13, Pa. **L-4-9**

Grinding

Discussion of "Visible Grinding" method which permits operator to see through the grinding wheel to his work is covered in 4-page illustrated folder; includes instructions and parts lists as well as description of equipment. Carl Hirschmann Co., Inc., 30 Park Ave., Manhasset, N. Y. **L-4-10**

Epoxy Adhesives

Folder describes characteristics of new group of epoxy adhesives called Epibond for applications involving metal, plastic and ceramic bonding. Furane Plastics, 4516 Brazil St., Los Angeles 39, Calif. **L-4-11**



HIGH SPEED PRECISION BENDING with DI-ACRO* Hydra-Power Bender!

Simple and complex bends are readily formed and duplicated in many ductile materials with hydraulically operated Di-Acro Benders. The Bender can be delivered completely tooled for bending moulding, extrusions and other solid materials. Tooling can be made in your own plant if you prefer.

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Send for 32-page catalog

Gives complete information on Di-Acro Hydra-Power and hand Benders. Also describes hand and power operated Di-Acro Brakes, Notchers, Punch Presses, Rod Parters, Rollers and Shears.



Creators of "Die-Less Duplicating"

O'NEIL-IRWIN MFG. CO.
375 8th Ave.
LAKE CITY, MINN.

di-acro PRECISION METALWORKING MACHINES

INDICATE A-4-212-2

Tracer Control Techniques

Twenty-four page report on first annual Contour Machining Conference covers recent developments of tracer-controlled production methods as discussed in speeches and panel discussions. Request only on company letterhead directly to True-Trace Corp., 9830 E. Rush St., El Monte, Calif.

Magnetic Chucks

Comprehensive catalog No. 412 covers line of rectangular, rotary and sine angle magnetic chucks and magnetic work drivers; also includes discussions of such accessories as control switch equipment, demagnetizers, and magnetic parallels and V-blocks. Well illustrated to show equipment and its uses. The Taft-Peirce Mfg. Co., Woonsocket, R. I. **L-4-12**

Inserts

Tap-Lok self-tapping inserts, threaded inside and out and with cutting edges for use in metal and plastics, described in 12-page booklet; explaining various features, installation and applications; well illustrated with photos and drawings; includes specifications. Groov-Pin Corp., Ridgefield, N. J. **L-4-13**

Plastic Tools

Practical information on production of dimensionally stable foundry tools presented in illustrated technical bulletin, "Plastics in the Foundry Industry"; outlines their advantages and describes working procedures step by step; also offers information on construction and proper preparation of molds. Marblette Corp., 37-21 Thirtieth St., Long Island City 1, N. Y. **L-4-14**

Tap Chart

Twelve comprehensive quick reference tables arranged on wall chart cover tap pitch tolerances compared with NSTC and Unified Thread Class Fits, tap drill sizes, suggested tapping speeds, suggested tapping lubricants for irons, steels and alloys being tapped, rake angles for tapping various materials, decimal equivalents, and tap terminology. The Wood & Spencer Co., 1930 E. 61st St., Cleveland 3, Ohio. **L-4-15**

Ceramic Molds

Four-page Ceramicast bulletin deals with process for producing close tolerance steel castings from ceramic molds; traces development and principles of the process; illustrates major applications, and discusses advantages. Lebanon Steel Foundry, 160 Lehman St., Lebanon, Pa. **L-4-16**

W-T WALKER-TURNER



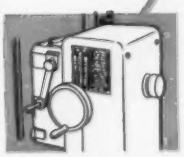
Rugged, rapid Blade Welder optional at extra cost

COMPARE — You'll see that you get a lot more for your money when you buy W-T "Light-Heavyweights"!

You can vary speed from 50 sfm to 4500 sfm while this machine is running!

No time-wasting belt changes! No incorrect speeds! Turn the hand wheel, and you vary speed of this Walker-Turner "LIGHT-HEAVYWEIGHT" 16" Band Saw from 50 to 450 sfm in low range, and from 500 to 4500 sfm in high range—in stepless, smooth variation, while the machine is running.

Gives you the right speed instantly for anything that's cuttable — tough steel, non-ferrous metals, plastics, wood. Ask your Walker-Turner Distributor to show you what this precision-cutting saw will do for you. He's listed under "Tools" in your phone book's Yellow Pages. Or write today for his name, and full information.



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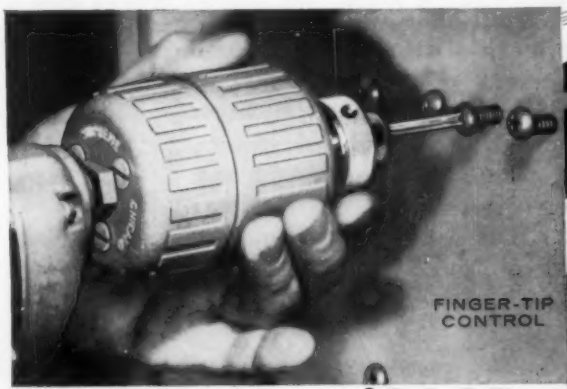
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a high quality, low cost
REVERSIBLE
SPEED REDUCER

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Supreme Versamatic
PROFESSIONAL MODEL
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COMPLETE 14-PIECE SET . . . ONLY $24.95

Engineered and manufactured by the makers of

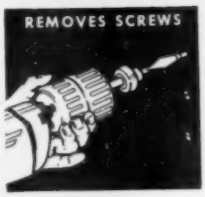
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The line that's UP FRONT on America's leading power tools

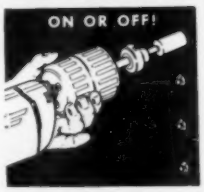
SUPREME PRODUCTS, INC., 2222 S. CALUMET, CHICAGO, ILLINOIS

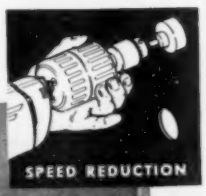
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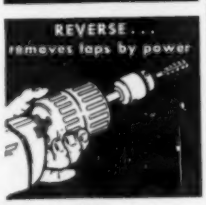












Lathes

Eighty-page Golden Anniversary Catalog, published in celebration of company's 50th year, covers line of precision engine, toolroom and turret lathes, shapers, pedestal grinders and drill presses, introduces new vertical spindle milling machine and 13-in. swing turret lathe, and also shows attachments, chucks, tools and accessories; well illustrated with photos and drawings; tabulations give specifications, capacities, floor space requirements and shipping weights. South Bend Lathe Works, South Bend 22, Ind. **L-4-17**

Clutches

Catalog 103-C, designed for use as a quick reference selection guide, covers line of standard clutches and clutch-coupling units, illustrated by cutaway photos, cross-section drawings, application suggestions, dimensions and engineering data. Formsprag Co., 23601 Hoover Rd., Van Dyke, Mich. **L-4-18**

Hydraulic Systems

Wall chart, "Trouble-shooting Chart for Hydraulic Systems," outlines various causes and their solutions for common specific hydraulic system problems. Industrial Products Dept., Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa., or Sun Oil Co., Ltd., 600 University Ave., Toronto 2, Ontario. **L-4-19**

Thread Milling

Complete line of semiautomatic thread milling machines for producing threads with one turn discussed in detail in 16-page illustrated catalog; includes description of cam action, machine specifications, case histories, special adaptations and tables of feeds and speeds. Hanson-Whitney Co., Div. of Whitney Chain Co., Hartford, Conn. **L-4-20**

Drafting

"11 Ways to Save Drafting Time" discusses specific ways to use intermediates to make quick modifications of drawings without changing the original; each of the time-saving techniques clearly illustrated. Frederick Post Co., 3666 N. Avondale Ave., Chicago 18, Ill. **L-4-21**

Wire Drawing

Illustrated 8-page No. 786-W-3 brochure describes company's continuous tandem wire drawing machines including the drum, block and combination types for drawing brass, copper, aluminum and other nonferrous metals. Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. **L-4-22**

who's meeting and where

Apr. 4-6. American Society of Lubrication Engineers. Annual meeting and lubrication exhibit, Hotel William Penn, Pittsburgh, Pa. For more information contact society office, 84 Randolph St., Chicago 1, Ill.

Apr. 10-11. American Society of Mechanical Engineers. Machine design conference, Bancroft Hotel, Worcester, Mass. Write to society offices, 29 W. 39th St., New York 18, N. Y. for more details.

Apr. 10-12. Metal Powder Association. 12th annual meeting and 1956 Metal Powder Show, Hotel Cleveland, Ohio. Additional information is available from association office, 420 Lexington Ave., New York, N. Y.

Apr. 18-20. Armour Research Foundation of Illinois Institute of Technology. National industrial research conference, to be held as part of Foundation's 20th anniversary. Further details may be obtained from Institute, 35 W. 33rd St., Technology Center, Chicago 16, Ill.

Apr. 21. State University of Iowa and American Society of Tool Engineers in conjunction with ASME, AIIE, IEAI and other Iowa and Western Illinois organizations are sponsoring the second annual Engineers-Management Conference. More details may be gained from the University's School of Engineering, Iowa City, Iowa.

Apr. 29-May 3. Electrochemical Society. Semiannual meeting, Mark Hopkins Hotel, San Francisco, Calif. More information is available from Ruth C. Sterns, managing editor, *Journal of the Electrochemical Society*, 216 W. 102nd St., New York 25, N. Y.

May 3-9. American Foundrymen's Society. 60th annual foundry congress and exhibit. Convention Hall, Atlantic City, N. J. For further facts, contact society headquarters, Golf and Wolf Rds., Des Plaines, Ill.

May 4. The Ohio State University, College of Engineering. Annual conference for engineers. Get further information from Assoc. Dean Harold A. Bolz, College of Engineering, The Ohio State University, Columbus 10, Ohio.

May 9-11. American Welding Society. National spring meeting, and fourth Welding and Allied Industry Exposition, Buffalo, N. Y. Definite data is available from society headquarters, 33 W. 39th St., New York 18, N. Y.

May 14-17. Design Engineering Show. First of annual shows to be devoted to original equipment which goes into manufacture of finished products. Convention Hall, Philadelphia, Pa. Contact exposition managers, Clapp & Poliak, Inc., 341 Madison Ave., New York, N. Y.

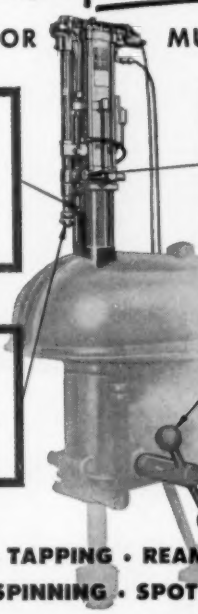
May 16-18. Society for Experimental Stress Analysis. Spring meeting, William Penn Hotel, Pittsburgh, Pa. Contact society office. P.O. Box 168, Cambridge 39, Mass. for details.

May 17-18. American Institute of Industrial Engineers. Seventh annual conference on fundamentals, current practice and recent advances. Shoreham Hotel, Washington, D. C. Further facts may be had from institute office, 145 N. High St., Columbus 15, Ohio.

May 23-24. American Iron & Steel Institute. Annual meeting, Waldorf-Astoria, New York, N. Y. More information is available from institute office, 350 Fifth Ave., New York 1, N. Y.

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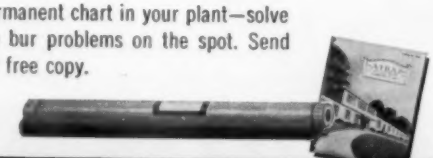
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May 24-25. PURDUE UNIVERSITY, School of Mechanical Enginering. Conference on mechanisms, to be held at the university, West Lafayette, Ind. Get more information from the School of Mechanical Engineering.

May 28-30. National Fluid Power Association. Annual spring meeting, The Greenbrier, White Sulphur Springs, W. Va. For other information, write association headquarters, 1618 Orrington Ave., Evanston, Ill.

June 3-8. SOCIETY OF AUTOMOTIVE ENGINEERS, INC. Summer meeting. Chalfonte-Haddon Hall, Atlantic City, N. J. More facts are available from Society office, 29 W. 39th St., New York 18, N. Y.

June 5-8. THE MATERIAL HANDLING INSTITUTE'S Exposition of 1956. Technical sessions and Exposition, solely for material handling equipment, Cleveland Auditorium, Cleveland, Ohio. Further facts may be secured from institute office, Suite 759, One Gateway Center, Pittsburgh 22, Pa.

June 11-15. THE SOCIETY OF THE PLASTICS INDUSTRY, INC. 7th National Plastics Exposition, New Coliseum, New York, N. Y. Request further facts from society headquarters, 67 W. 44th St., New York 36, N. Y.

June 17-21. AMERICAN ELECTROPLATERS SOCIETY. 43rd annual convention. Hotel Statler, Washington, D. C. Full information may be had from society office, 445 Broad St., Newark 2, N. J.

June 17-22. AMERICAN SOCIETY FOR TESTING MATERIALS. 59th annual meeting and 12th apparatus exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J. Write for particulars to society office, 1916 Race St., Philadelphia 3, Pa.

June 17-22. THE PENNSYLVANIA STATE UNIVERSITY. Creative engineering seminar. Write for further information to the university's General Extension Information, University Park, Pa.

June 25-29. THE AMERICAN SOCIETY FOR ENGINEERING EDUCATION. Annual meeting, Iowa State College, Ames, Iowa. For more facts contact society's secretary, W. Leighton Collins, University of Illinois, Urbana, Ill.

June 27-July 6. INTERNATIONAL ELECTROTECHNICAL COMMISSION. Annual meeting. Delegates will be guests of the German National Committee of IEC at Munich, Germany. Address inquiries to the United States National Committee, c/o American Standards Assn., 70 E. 45 St., New York 17, N. Y.

Readers' Viewpoints

. . . plugs and rings

To the Editor:

In the article "How to Design Non-sticking Plugs and Rings," in the February issue of The Tool Engineer, two typographical errors occurred and should be brought to the attention of the readers.

The first error is at the top of the left-hand column on page 112. The paragraph should read:

> If a 6-inch diameter workpiece has a hole 0.0003 inch larger than a locating plug . . .

The other error is directly below the first in the example formula. The formula should read:

$$l = \sqrt{2\ (6)\ (0.0003)} = 0.060 \text{ inch}$$

Robert J. Hornacek
Tool Engineer
Tool Research Dept.
Buick Motor Div.
Flint, Mich.

Reader Hornacek is correct in both instances. *ED.*

. . . unions

To the Editor:

Mr. Begeman in his article "Unions for Engineers" in the June 1955 issue of The Tool Engineer touched on the subject of the trends toward unionization of the engineering profession. He points out, however, the many disadvantages of a union and proposes an alternate method of obtaining the desired economic gains.

The solution to the problem is an over-all engineering organization to handle the professional, social, and economic problems of the engineer. This suggestion has been made several times previously and has associated with the little understood and uninspiring title of "Unity" or a "Unity Organization."

Mr. Begeman proposes that the unity organization should publicize the work of the profession at the local, state, and national level, and should encourage the engineers to register and to participate in civic affairs.

The author and his associates, as representatives of the General Electric Engineers Council (a council represented by "sounding board" organizations in seven of the major General Electric plants), have studied this same problem, and are of the opinion that the unity organization should not be as limited in its activities. It is the feeling of the author and his associates that a unity organization would be of greatest value if it also concerned itself with:

1. Utilization of engineers
2. The effect of labor laws on the engineers
3. Legislation
4. Registration laws
5. The present selective service policy
6. Engineering shortages
7. Gentlemen's agreements and freedom of employment
8. Educational standards for engineers
9. National security problems

A close study of the existing engineering organizations quickly illustrates that the National Society of Professional Engineers fits most of the basic structural requirements. NSPE could be and should become the unity organization. This can only come about when more and more engineers join it and give generously of their leadership and assistance.

J. L. Oldenkamp
General Electric Engineers Council
Fort Wayne, Ind.

As the above subject is timeless, readers' viewpoints are always appreciated. *ED.*



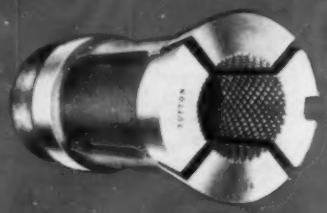
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3 REASONS WHY SUTTONS ARE THE BEST BUY!

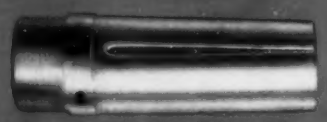
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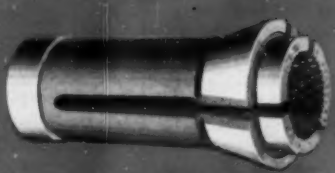
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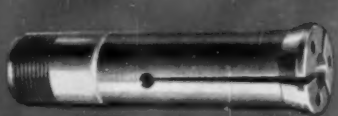
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Nuclear Techniques in Testing

foreshadow wider use in industry

Tech Digests

By John L. Kuranz
Nuclear Instrument & Chemical Corp.
Chicago, Ill.

IN THE FIELD OF TESTING, radioisotopes are destined to be widely used for important analysis and control operations. They provide a test tool which is so highly sensitive that it can handle work impossible with conventional methods. For example, it can monitor at high speed, the thickness of paper, plastic, rubber, steel, and other metals to high precision without contact. When highest sensitivity is unnecessary, radioisotope technique may be modified to give an even quicker or simpler test.

Although high sensitivity, which gives rise to quick and simple analysis, is probably the main virtue of the radioisotope and test methods, the fact that this new tool is highly versatile and can be made specific is also important. However, these methods are far from an answer to all test problems.

Most testing with radioisotopes involves either the effects of the radiation on the material as in activation analysis, effects of materials on radiation as in gaging, or tracing an element or compound with radio chemicals.

In thickness gaging, the effect of material on radiation is utilized. The detector monitors the change in intensity of radiation beam as it changes in proportion to the thickness or density of the interposed material. There are many variations of this technique which can be fitted to various testing jobs.

As a tracer, radioactivity is added to the process as a tag or label. Although there are many variations, they all depend on the premise that chemicals made with artificial radio elements behave the same as their natural chemical counterparts. Precision of detection of radioactivity is utilized to locate and measure any chosen chemical in a process.

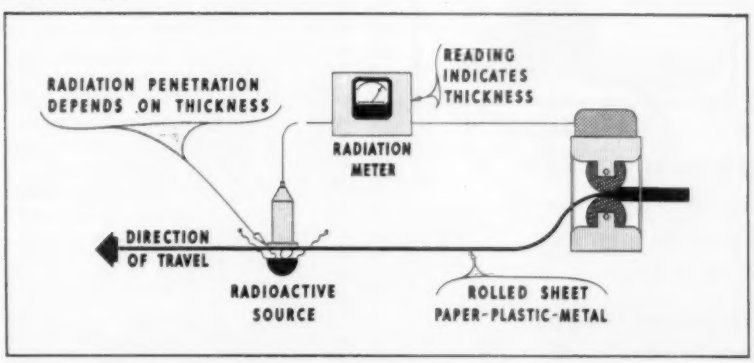
Gaging Uses

An instance is a gage designed to determine the ratio of hydrogen to carbon in petroleum processing. This device uses the absorption of beta radiation as its principle of operation. Beta particles are absorbed in proportion to the number of electrons present in the material and carbon has half the number per unit weight as does hydrogen. If one then knows the total weight of hydrogen plus carbon in a liquid hydrocarbon, and the total number of electrons, he can calculate the ratio of hydrogen to carbon atoms. The machine developed for the purpose can determine to a probable error of 0.002 percent by weight. This ratio, in a time of three minutes. An analysis by the combustion method to the same accuracy requires from one to two hours' work by a careful chemist.

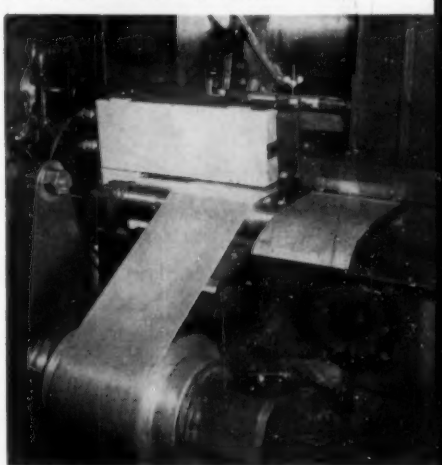
Wear Detection

In wear studies, radioisotopes are used as tracers or tags. In this technique, a part subject to wear is made radioactive. This might be a piston ring. By measurement of transfer of radioactive iron to the lubricating oil in the crankcase, one can determine very precisely the removal of extremely small amounts of metal. One oil company carried out such a test program that would have cost a million dollars using old methods of disassembly and measuring sizes of various parts and would have required 60 years to com-

Setup for gaging thickness of materials with radioactive means. Results are rapid and reliable without contact with material. Signal from radiation meter controls roller settings.

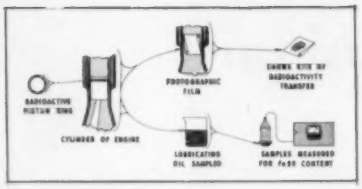


Beta ray thickness gage on brass mill in Revere Copper & Brass plant demonstrates utilization of nuclear technology for industrial processes.



plete. With the new method, the work was done in less than 4 years on a research budget totaling about $35,000. Similar wear testing has been conducted by manufacturers of cutting tools to determine how much of the tool made of different materials is removed during the cutting operation.

These instances illustrate the fact that there are many testing tasks that isotopes can effectively accomplish.



Nuclear technique for wear studies is exemplified in this setup to detect transfer of metal from engine to oil.

Some can be effected in no other way. Facilities and personnel are within reach of the usual engineering or analysis operation. Most of the really worthwhile uses of radioisotopes in testing have yet to be uncovered and they will be discovered by well-informed industrial technical people rather than atomic scientists.

From a paper given at the Nuclear Engineering and Science Congress, Dec. 1955, Cleveland, Ohio. Published as preprint No. 160 by American Institute of Chemical Engineers, 25 W. 45th St., New York.

▼ ▼ ▼

Profile of Engineering Executives

By Granville M. Read

Chief Engineer
E. I. du Pont de Nemours & Co.
Wilmington, Delaware

Recent discoveries and developments of new materials have accelerated engineering progress. Human materials, however, are the most important contour of any engineering profile. They are obviously the source of all technological gains.

If human beings are viewed the way an engineer looks at physical materials, the importance of fitting them into the right place in the structure of society is evident. No tests have yet been devised to measure the potentialities in the human being. There are some yardsticks, however, which can be applied. These include health and energy of an individual, his durability, his intelligence, his education, his creative ability.

Does he have the courage and imagination to leave the beaten track? What is the caliber of his thinking, his determination, his dependability and his common sense? What is his attitude? Is he courteous to all and subservient to none? Is he loyal—to his company, his profession, his boss and above all to himself? Does he stand up for what he believes in and fight for it? Does he observe the golden rule in his relations with others?

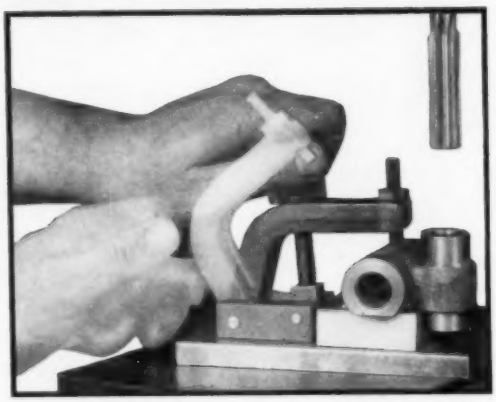
In looking for a prospect to train for an executive post in engineering, health and spiritual character would be considered, of course. Other characteristics might weigh as follows: leadership, 25 per cent; courage, dependability and the humanities, 15 per cent each; formal education, creative power and economic prudence, 10 per cent each.

Human materials, like construction materials, must be tested continuously and at various load levels to determine their carrying capacity. If weak members are found, they must be strengthened. Managements often fail to maintain a live inventory of their human potentials.

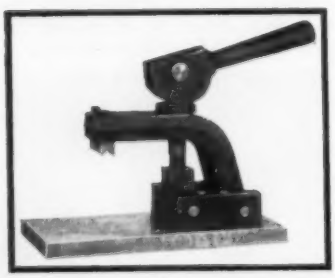
Experience during the war showed that older men had difficulty keeping

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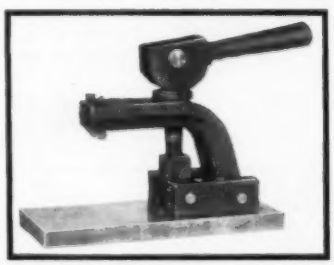
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pace with the fast schedules required. They could guide and render managerial experience in some phases of the operations, but even there great care had to be exercised that they did not try to put on the brakes. It was necessary to turn to younger men.

Even today management is tardy in giving young men greater responsibility. There are too many older men calling the shots and missing the targets. Future progress may depend upon whether younger men are given responsibility they and they alone are capable of exercising. Another suggestion, why should not colleges and universities provide prospective employers with a profile of human characteristics of the graduate as well as his academic standing? More emphasis should be placed on determining other characteristics than a retentive memory. This would aid industry in sorting out candidates for specific jobs and would facilitate the early placement of graduates in positions they fit.

Further in the formative years on the campus, it would be helpful if college instructors discussed the importance of the humanities of life, for these may prove more valuable in later years than the ability to solve the most intricate mathematical problem.

From an Address given at the Centennial Symposium on Modern Engineering, U. of Penn., November 11, 1955.

▼ ▼ ▼

Grinding Fluids for Titanium

By M. C. Shaw
Mechanical Engineering
Massachusetts Institute of Technology
Cambridge, Mass.
and
C. T. Yang
Research Engineer
Ford Motor Co.
Dearborn, Mich.

Dilute aqueous solutions of certain inorganic salts are very effective in decreasing the rate of grinding wheel wear and providing decreased surface roughness in finishing titanium-alloy surfaces. A systematic study of a large number of salt solutions has revealed that such solutions act by the formation of adsorbed cationic and anionic layers on the aluminum-oxide and titanium surfaces, respectively.

These layers prevent the abrasive and chip surfaces from coming close enough together to form strong bonds, which when broken, remove pieces of abrasive from the system. In the choice



of a suitable material, ion size and effective charge are found to be two items of major importance. Barium was found to be the most effective element in the periodic table for adsorption on aluminum oxide. The phosphate radical was most effective anion investigated for adsorption on the surface.

From paper No. 55-SA-39 ASME Semi-Annual Meeting, Boston, Mass., June, 1955.

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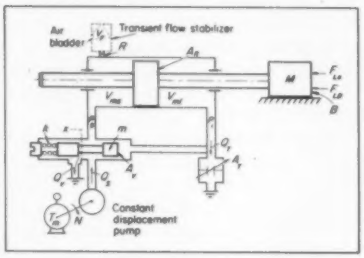
Engineering with Analog Computers

By Gerhard Reethof
Dynamic Analysis and Control Laboratory
Massachusetts Institute of Technology
Cambridge, Mass.

Use of analog computers has had phenomenal growth in engineering groups. In many studies, an investigation is made of behavior of an assemblage of commercially available components. Another promising field for use of analog computers lies in utilization as a design tool in conceptual stages of a development.

This paper exemplifies this method and demonstrates an approach to the design problems which attempts to utilize simple mathematical techniques to first form a good physical understanding of the system, followed by an exhaustive "designing with the analog." This first stage of familiarization is of the greatest importance to proper utilization of analog computer potentials. Unless a good qualitative performance prediction can be made from a basic physical understanding of the problem, use of the computer is misplaced.

Schematic diagram of hydraulic system designed with use of analog computer.



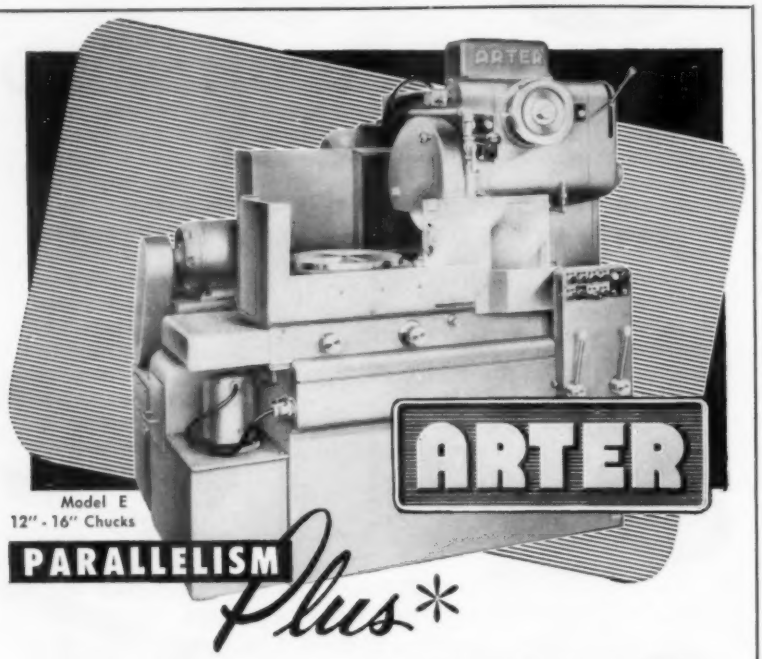
The system considered in this paper is one in which control of velocity is desired. Shown in the accompanying figure is a schematic diagram of the system. Flow from the downstream side of a fluid motor is to remain constant thereby maintaining a constant ram velocity.

Preliminary fundamental analysis should serve to give a better insight into the quantitative aspects of the problem. Its purpose is twofold:

1. To set up algebraic and differential relationships which best describe the system and to present these equations in a suitable form.

2. To manipulate these relationships prior to the analog study in order to understand the speeds of response of various components of the systems. Thus, certain portions of the system may respond so fast to variations in the system variables as to appear to act instantaneously, relative to some slower portions.

   However, the justified neglecting of the dynamics of this faster but stable system may result in a considerably simpler analog setup. Prior study of the fast system alone must have proved its stability.



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Use of the analog computer as a design tool in design and development of equipment such as this is unquestionably established. The analog should become as familiar a piece of equipment as the slide rule. Design and development engineers should have free access to computers. Moreover, they should be charged with setting of the problem into the computer and subsequent designing with the analog.

The computer, however, will only solve problems the engineer comprehends. If certain important distributed or lumped effects are neglected, answers from an analog study can be embarrassingly misleading. If, however, a reasonable facsimile of the physical system is studied by the analog approach, an excellent physical understanding of the apparatus will be gained which will reduce immeasurably the experimental time during prototype development phase. An important aspect is the encouragement to experiment analytically and an attempt to outguess the computer, thereby coming up with a daring solution to an otherwise difficult problem.

From a paper given at the National Conference of Industrial Hydraulics, Oct., 1955.

▼ ▼ ▼

Advances in Airframe Manufacturing

By Boyd K. Bucey
Tool Design Manager
Boeing Airplane Co.
Seattle, Wash.

New tools and improved techniques have been developed to work special materials to the extremely close tolerances required to overcome stresses and vibrations encountered in jet flight. Through emphasis on research and development programs, manufacturing divisions have been able to make rapid progress and keep pace with advances in aerodynamic and propulsion designs.

Many interesting manufacturing and tooling developments have been made in recent years. Many of the new techniques are important for the future. One such development is the construction type known as integral structure. These parts must either be milled from solid slabs, rolled, extruded or forged. The industry is also concerned with composite assemblies in which parts are joined by riveting, welding or metal bonding. Manufacturing techniques are required for new materials such as titanium and its alloys, high-strength

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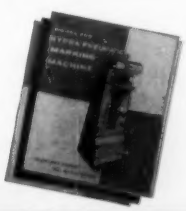


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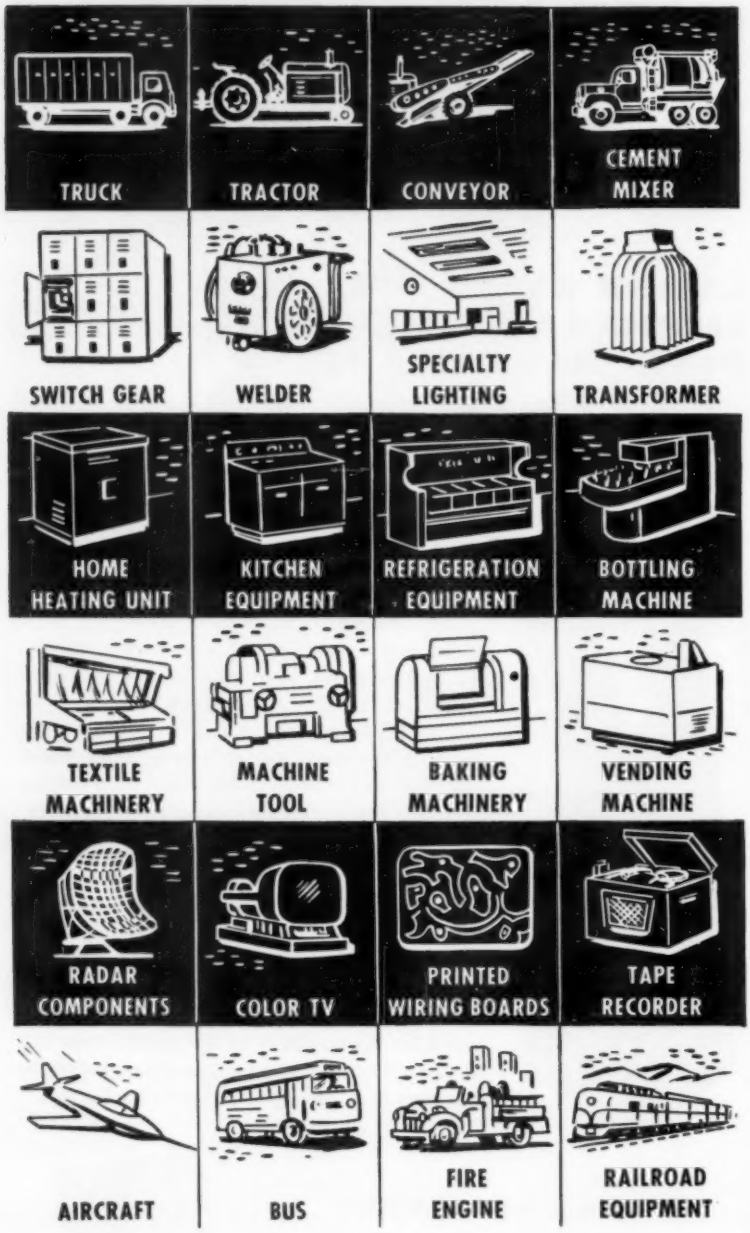
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steel and plastics and the like.

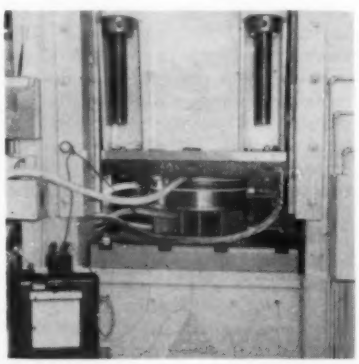
Chipless production, or material manipulation has also evoked great interest. New techniques and tools have been developed in the fields of metal cutting, metal forming, machining and tube bending. Standardized tools, techniques and processes have resulted from this emphasis on research and development.

An important operation in airplane manufacture is cutting metal sheets, strips or plates. Major new achievements in this field include development of friction sawing methods, tracer-controlled flame torch equipment, portable skin saws and power routers.



Tracked skin trimmer and hole router used to trim skin of panel.

Hot forming metals such as titanium, is associated with many problems. A comprehensive study has provided some optimum forming temperatures for several metals: 325 F is best for aluminum alloys and hard magnesium, 550 for annealed magnesium and commercially pure titanium, and 1000-1100 F for titanium alloys. Steam heating of dies was found best for temperatures up to



Temperature tests with steam heated draw die is typical development job.

350; hot oil pumped through dies proved adequate for 550, and internal combustion of premixed gas is best for temperatures over 1000 F.

Standardization

Aircraft companies are standardizing more and more of their tooling and manufacturing processes. Standardization and documentation of the processes reduces cost and time needed to tool up. Moreover, such programs result in better tools, parts and facilitate subcontracting. Standard scaffolding, for example, had long been overlooked.



Fin work scaffold uses standardized components for substantial cost savings.

As much as $400,000 has been saved by a standardization program of this item. Scaffold sections are made from prefab assemblies with commercial items, such as plated pipe and pipe fittings, fireproof plywood, magnesite floor surfacing, etc. Subjects of other tool engineering records include automatic riveting, templates, aircraft gages, spar cap milling, stretch presses, optical tooling, concrete jigs, scheduling, dies, trimming, hydropress, plastics, mat molding, machine fixtures, profile tooling and cutting tools.

The development of better tools and equipment to meet design requirements of jet aircraft and other improvements in manufacturing methods have reduced costs as machine hours are substituted for man-hours. In the past, three-fourths of the cost of manufacturing an airplane was attributed to subassembly and final assembly hand work, such or boring, trimming and shimming to required tolerances. Remaining quarter was taken up in fabrication of detail parts.

Now the cost ratio is changing. By maintaining close tolerances through all phases of parts manufacture, many



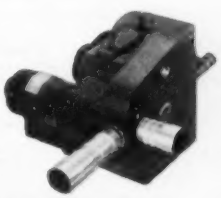
When it sings out, engineering mysteries unfold

The high-pitched whine of a high speed camera is bursting forth more and more often in modern engineering laboratories. For engineers have found that ultra-slow-motion movies make trouble shooting in fast-moving parts more a matter of intelligent visual analysis than of tedious cut-and-try experimentation or calculation. And that leaves them more time for design and development work.

The high speed camera we make is primarily for the practical engineer to use in helping solve his day-to-day problems. Its top speed is a reasonable 3200 pictures a second. That slows action 200 times when you project the 16mm film at normal speed, enough in the great majority of mechanical problems to see what's going on. You don't burn up more film than you need and the instrument is simple and rugged enough for a busy man to use without trouble.

The best way for you to evaluate the Kodak High Speed Camera in terms of your own needs is to send for a booklet that not only gives you the details but quite a few case histories on how it has been used in a variety of industries. You get the booklet by writing to *Graphic Reproduction Division,*

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We call it "built-in lubrication" because our *unique Crōmclad treatment** gives these taps a free-cutting action . . . *always slippery-smooth!* What's more, this "built-in lubrication" reduces loading, resists abrasion, carries your lubricant farther, makes your tapping almost friction-free!





Tapping is tough work, and you need all the help you can get. Suppose, for example, you are tapping stainless steel, B-Monel, or an equally difficult material. By using

Crōmclad® TAPS

you get maximum help, for *the tougher the job the better the Crōmclad treatment shows up!* (Try Crōmclad Taper Pipe Taps, for example!)

Priced no higher than conventional ground thread high speed steel taps, Crōmclad Taps with "built-in lubrication" carry an unconditional guarantee to perform to your satisfaction or they may be returned for full credit.

Mail coupon today for detailed price list which shows ***attractive quantity discounts* available on all Crōmclad Taps.**

* Crōmclad treatment is not "just another chrome plating process". It is a special hard chrome surface treatment (less than .00005" thick) developed by us specifically for taps, and *will not peel or chip* even when the taps are sharpened.

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final assembly operations are eliminated. Although costs of more accurate detail parts increases, over-all manufacturing costs are reduced.

From a paper "Development of Airframe Manufacturing Methods" presented at the annual meeting, Jan. 1956, Society of Automotive Engineers, 29 W. 39th St., N. Y. 18, N. Y.

▼ ▼ ▼

Heat Treatment of Air Hardening Alloys on Welding

By J. J. B. Rutherford and J. F. Ewing

Babcock and Wilcox Co. Barberton, Ohio

With the application of welding as a method of fabricating higher carbon and alloy steels, it has become customary to recommend practices of preheating and post heating, or stress relieving weldments. Preheating serves mainly to mitigate stresses originating from thermal shock associated with arc welding. A secondary function of preheating is to minimize notch sensitivity or to increase ductility.

A high rate of cooling from the welding operation leads to the formation of martensite and results in a highly stressed weldment. The rate of cooling is relative; low carbon steel may be martensitic on spot welding but this condition is much less likely when large sections or multibead practices are involved. If preheating is performed above the martensite transformation, Ms, temperature, then the weld-affected zone will cool rapidly to the preheat temperature but subsequent cooling and martensite formation will be retarded. This is not good practice as it may first appear because the austenite formed on heating will be retained on cooling, on subsequent stress relieving and then transform to martensite. On the basis of tests performed during this investigation, it is recommended that the preheating temperature should be significantly below the Ms for the materials involved. The weld area should be cooled below the Ms before being stress relieved or annealed.

From a paper given at the AWS National Fall Meeting, Oct. 1955, Philadelphia, Pa.

FOR AVAILABILITY OF COMPLETE PAPERS WRITE THE HEADQUARTERS OFFICE OF THE SOCIETY NOTED AT THE END OF EACH ABSTRACT.

High Production Welding of Rear-Axle Housings

By E. P. Lommel
Chevrolet-Buffalo Div.
General Motors Corp.
Buffalo, N. Y.

Rear-axle housings of production models are partially welded in high volume. One of the more critical welds is a fillet weld joining a carbon-steel flange to each end of the carbon-steel housing. This joint must take the full torque of braking and of the engine. The joint is made by means of a mechanized, straight-polarity inert-arc consumable-electrode weld with direct current from a constant-potential power-supply unit. Inert gas is a mixture of 98 percent argon and 2 percent oxygen.

Before adoption of this process, two other welding methods were tried on a production basis. With the first, production was limited to 45 housings per hour; with the second, a poor weld frequently resulted even though production increased. Inert-arc consumable-electrode welding, on the other hand, has increased production to 150 housings per hour while eliminating difficulties of the weld itself.

The decision to adopt this type of welding required solution to several problems. With the solution of these problems, substantial cost savings have been effected. The paper discusses in detail how these problems were met.

FOR AVAILABILITY OF COMPLETE PAPERS WRITE THE HEADQUARTERS OFFICE OF THE SOCIETY NOTED AT THE END OF EACH ABSTRACT.

From a paper given at the American Welding Society National Fall Meeting. Oct., 1955, Philadelphia, Pa.

▼ ▼ ▼

Radioisotope Materials Utilized in Markings

By C. W. Wallhausen

Vice President
U. S. Radium Corp.
New York, N. Y.

Self-luminous compounds consist of a phosphor mixed with or used in conjunction with a radioactive element or compound. Phosphor used include zinc or zinc-cadmium sulfides, silicates and tungstates, the first being the most efficient.

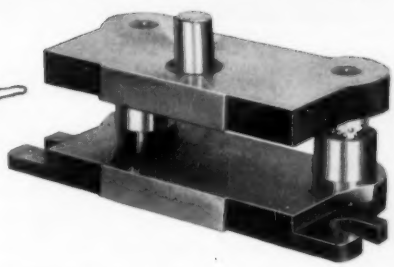
Uses of self-luminous compounds include safety marking in commercial aircraft, mines, public buildings or areas, illumination of instrument dials and panels, general low level illumination of rooms such as darkrooms, emergency markers in power plants or similar locations. Other are standard light sources for use with photometric equipment, activators for equipment using photo cells and color coding of equipment used in darkness.

Such applications are the result of nuclear engineering and indicate some of the attractive possibilities. Although great strides have been made in developing such compounds, much basic research and development remains to be done. However, with increasing availability of isotopes, price reductions and general education of public, many other applications become possible.

From an ASTM paper given at the Nuclear Engineering and Science Congress sponsored by Engineers Joint Council, Dec. 1955, Cleveland, O.

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Lempco die sets consistently deliver far more pieces between grindings—save on grinding and on down-time.

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Sold Everywhere Through Leading Industrial Distributors. Warehouse In Chicago, Ill.

PARKER-KALON® *fasteners*



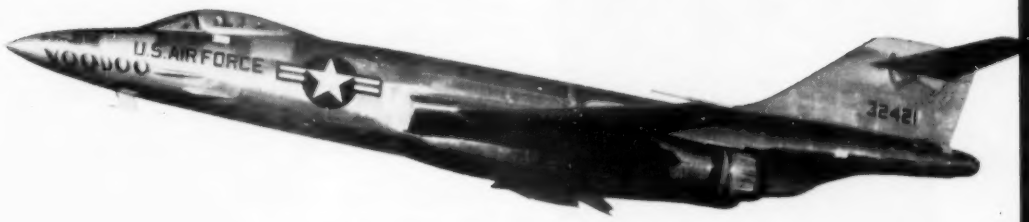
PARKER-KALON DIVISION • GENERAL AMERICAN TRANSPORTATION CORPORATION • CLIFTON, NEW JERSEY



An important cog in this nation's defense is this Air Force jet fighter, the F101A "Voodoo." By using laminated epoxy tooling, McDonnell Aircraft Corporation, its manufacturer, has reduced cost and speeded production of aircraft and helicopter components, some of which are incorporated in this plane. The epoxy plastic tooling compounds that are used are a product of **Ren Plastics, Inc.**, P.O. Box No. 1256, Lansing 4, Mich.

Compounds based on
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cut production costs, tooling time



Faster, less costly production of interchangeable aircraft components results from the advantages of "Ren" plastic tooling compounds based on BAKELITE Brand Epoxy Resins. For instance:

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- Up to 75 per cent of all the interchangeable door panels used in one aircraft have been assembled and coordinated with tools made of BAKELITE Epoxy Resin—glass cloth laminates.

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MOTORIZED ROTARY TABLE

for lapping and grinding

(not an index table)



With Lapping Plate

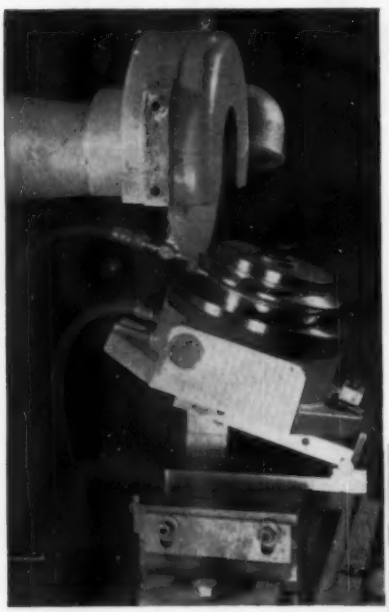
FASTER
circular precision grinding!

Now with this table and with less effort you assure highest standards of accuracy, flatness, finish and close tolerances. At the same time you eliminate slow and complicated tool setups. You cut grinding time greatly by using only cross feed while the table is rotating at infinite speeds between 40 and 100 RPM.

For example, Vulcan's Rotary Table can be used in connection with a sine plate or angle fixture. The dressing of large expensive external wheels for side grinding is therefore eliminated. If you wish we can provide permanent magnetic chucks designed for use with our table, both 6″ and 10″ in diameter.

Vulcan's Rotary Table is an air operated, self contained unit, portable between bench or machine. A precision center hole for locating and tapped holes in the table for clamping provides easy setup. Circular surface grinder applications are many and varied — grind flanged studs or bushings — bearing spacers — forming rolls — cutters — convex or concave surfaces — punches or dies (radius or angle).

Lapping? Yes — and in micro inches. For the 6″ and 10″ table, lapping plates of 12″ and 16″ are provided. Perfect for lapping valve plates, gages, bearing spacers and for carbide lapping using diamond powder. *Write for circular.*



Work clamped to motorized table, mounted on sine plate. Surface grinder application.

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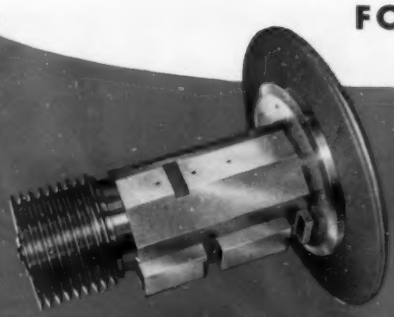
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Precision Spindle

BUILT ESPECIALLY FOR YOUR WORK



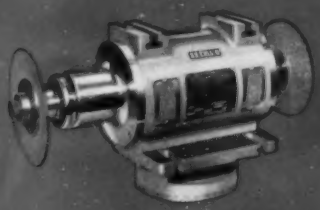
Single-body, belt-driven internal grinding spindle.



25 hp heavy duty precision spindle with 24" grinding wheel.



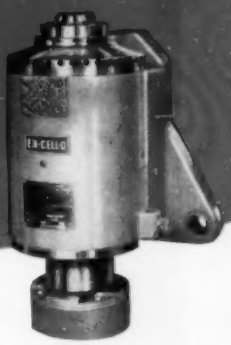
23,000 rpm high frequency inbuilt motor spindle.



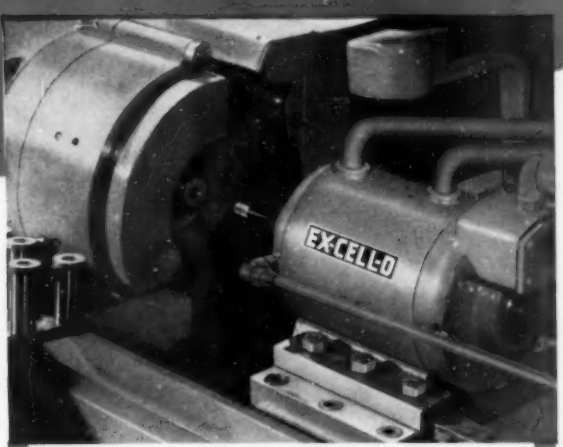
Precision inbuilt motor spindle for cutter grinder.



Totally enclosed inbuilt motor surface grinder spindle.



Heavy duty motorized precision spindle available up to 20 hp.



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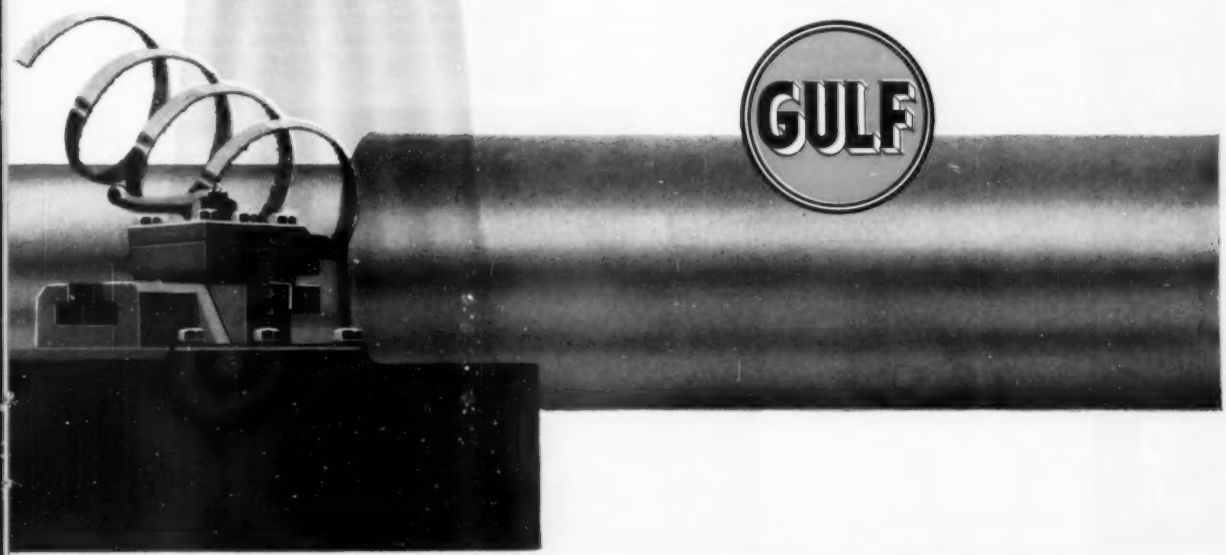
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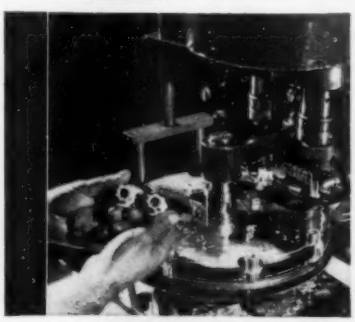
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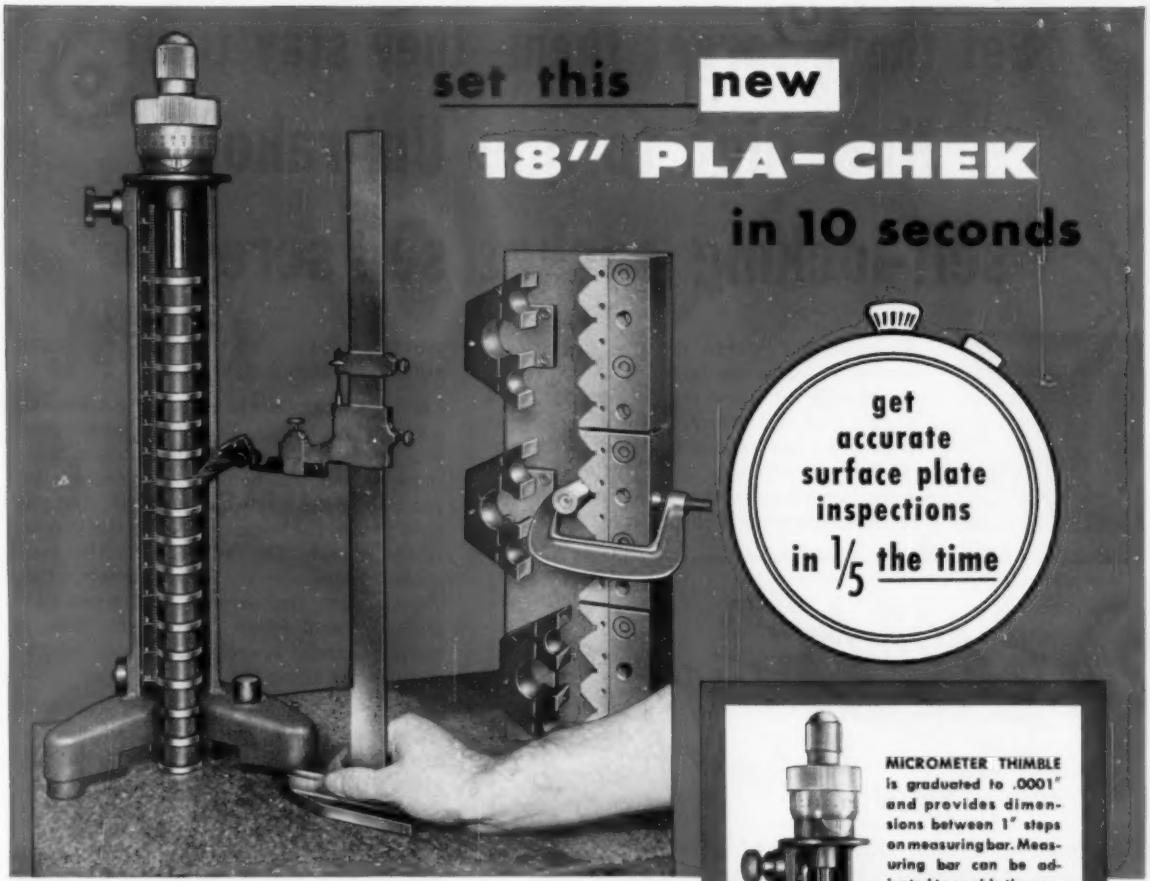
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accurate to .00005" throughout the 18" range

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Research has proved that the tighter you seat a set screw the better it works. So we designed a set screw that can be tightened tighter than ever before. We formed a deeper socket. We put a radius in the socket corner. We developed fully formed threads. We established new methods of heat treatment in atmosphere-controlled furnaces. All this, plus the well-known self-locking knurled cup point that keeps it tight.

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You can't buy a better set screw than an UNBRAKO. See your authorized industrial distributor today. Or write STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

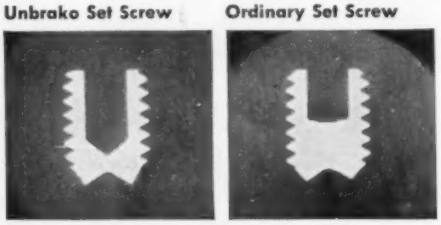
Up to 40% higher tightening torque— a new Unbrako feature

RECOMMENDED SOCKET SET SCREW TIGHTENING TORQUES
(Inch-Pounds)

SCREW SIZE	UNBRAKO	SET SCREW B	SET SCREW C	MINIMUM DIFFERENTIAL %
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#5	9	7.8	7.4	15
#6	9	7.8	7.4	15
#8	20	14.7	14.5	36
#10	33	26.5	25	25
1/4	87	62	60	40
5/16	165	122	125	32
3/8	290	198	225	29
7/16	430	309	350	23
1/2	620	460	500	24
5/8	1225	1106	1060	11
3/4	2125	1540	1800	18
7/8	5000	3660	4600	9
1	7000	5025	6500	8

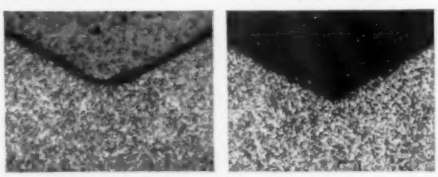
ALL UNBRAKOs can withstand higher tightening torques than ordinary socket set screws. For example, the recommended torque for a ¼" UNBRAKO is 87 inch-pounds—40% greater than that recommended for an ordinary socket set screw.

Unbrako Set Screw **Ordinary Set Screw**



COMPARE the socket depth. The UNBRAKO socket at the left is much deeper than the socket in the ordinary set screw at the right. This additional depth in the UNBRAKO socket gives you more purchase with the wrench—you can set an UNBRAKO much tighter.

Unbrako Set Screw **Ordinary Set Screw**



THE RADIUS put in UNBRAKO socket corners eliminates the sharp corners where cracks start. They distribute the stresses developed when tightening torques are applied. You can seat an UNBRAKO tighter without screw failure. Ordinary set screws have sharp corners which often crack when tightened even at lower recommended torques.

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the unseen ingredients
in the steel that
JESSOP makes
For 55 years in America and more than a century before that in England, the name Jessop has stood for high-quality specialty steels. This year with production at an all-time high and orders pouring in from good customers, new and old, one might assume that a company in Jessop's position would become complacent . . . would sit back and reap the harvest from former efforts, and rely on diplomacy to excuse slower deliveries.
Not so with Jessop. Jessop is a young and aggressive organization with a determination for absolute leadership. With business booming, Jessop is about to complete the first phase of an ambitious building program involving mills, furnaces, machines and, above all, good technical men. Jessop means to be sure that, as the tide of production rises, quality and service will not recede. Look at the list of products below. This is a good time to become a Jessop customer.
STAINLESS STEELS • HIGH SPEED STEELS • NON-MAGNETIC STEELS
HIGH SPEED TOOL BITS • HEAT RESISTING STEELS • STAINLESS-CLAD
PLATES • CARBON AND ALLOY STEELS • TOOL STEELS FOR SPECIAL
PURPOSES • CAST-TO-SHAPE TOOL STEELS • HIGH SPEED AND
ALLOY SAW STEELS • TEMPERED AND GROUND STRIP STEEL • COMPOSITE HIGH SPEED STEELS • STAINLESS AND HEAT RESISTING
CASTINGS • COMPOSITE DIE STEEL SECTIONS • PRECISION GROUND
FLAT STOCK • DIE STEELS—HOT AND COLD WORK
JESSOP
STEEL COMPANY · WASHINGTON, PENNSYLVANIA
OFFICES IN PRINCIPAL CITIES
Jessop Steel of Canada Limited, Wallaceburg, Toronto
Jessop Steel International Corp., Chrysler Building, New York, New York

SPRING STEEL RING

9" O.D. x 6¼" I.D. x .091" 50 pieces (100 surfaces) per hr.; .004" stock per side; limits ±.0005"

CAST IRON END PLATES

30 pieces (60 surfaces) per hour; ⅛" stock removed each side; limits ± .002"

ADJUSTING SCREW WASHERS

Low carbon steel; 200 pieces (200 surfaces) per hour; .025" stock removed; limits ± .001"

HOT ROLLED STEEL CAMS

225 pieces (450 surfaces) per hour; 1/16" stock removed each side; limits ± .001"

NOW! BLANCHARD PRESENTS ANOTHER GREAT NEW GRINDER

with Automatic Cycle Control

This great new Blanchard Surface Grinder performs a variety of jobs with speed, ease and accuracy.

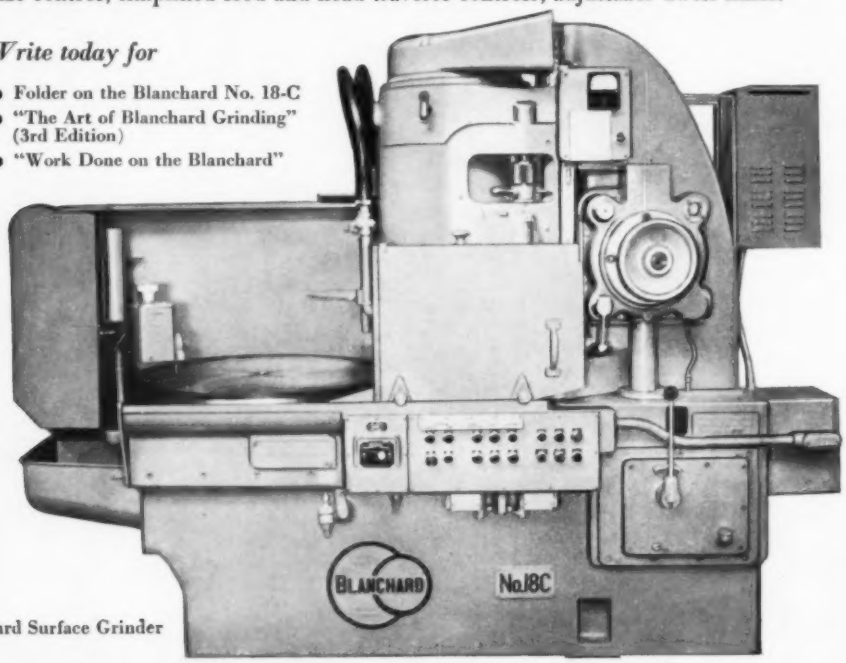
One operator can easily operate two of these No. 18-C grinders under balanced conditions. By using the automatic cycle, he can unload, clean and reload one grinder while the other is grinding.

Here's what the automatic cycle does: moves chuck (30" or 36" dia.) to grinding position and starts it rotating; starts wheel rotation and coolant pump; provides rapid wheel approach to work; engages power down-feed at preset rate; changes to fine feed just before finished size is reached; stops feed when work is to size – "sparks" out; raises wheel head; stops wheel, coolant pump and chuck; moves chuck to loading position – demagnetizes chuck.

This new Blanchard also features: push button selection of manual or cycle operation; size control; simplified feed and head traverse controls; adjustable dwell timer.

Write today for

- Folder on the Blanchard No. 18-C
- "The Art of Blanchard Grinding" (3rd Edition)
- "Work Done on the Blanchard"



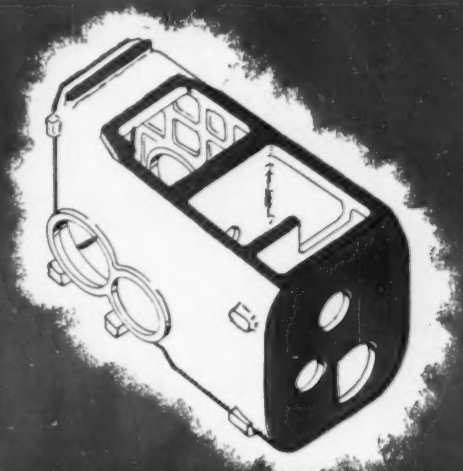
No. 18-C Blanchard Surface Grinder

THE BLANCHARD MACHINE COMPANY 64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-238

CUSTOMER SPECIFIED

One of the nation's famous-name farm machinery manufacturers required a big, high-speed, precision production milling machine which would mill several surfaces on huge, 625-lb. transmission case castings in a single setup.

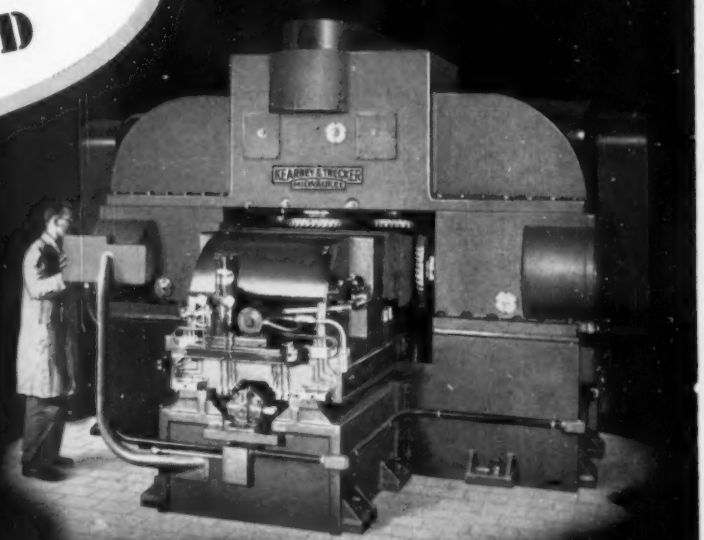


Green [illegible] on tractor transmission case.

KEARNEY & TRECKER MILWAUKEE DESIGNED

Kearney & Trecker's proposal was accepted and the result was this 44-ton, Five-Spindle Triplex machine which mills top, front and rear surfaces of tractor transmission cases at a rate of 23 pieces per hour.

Two horizontal spindles are mounted in duplex fashion and three vertical spindles on the massive bridge type head. Horizontal spindles, driven by 40-hp motors, carry 22" dia. cutters with 44 blades. Powered by a 50-hp motor, two of the vertical spindles have 22" dia. cutters and the third spindle a 6" dia. cutter with 12 tungsten-carbide blades.



New production efficiency starts with Kearney & Trecker Milwaukee machine tools

Kearney & Trecker automatic production machines perform many operations to exacting accuracies and at lower cost. But most important to you — it's accomplished by combining standard design components with a minimum of special engineering. This means you get the production you want, the economies you need, from job-proven designs with minimum of capital investment.

With more than 50 years' experience in machine design and manufacture, Kearney & Trecker has the all-around ability to meet your production needs. Take advantage of these abilities. They can pay off in lower machining costs and more profits for you. See your Kearney & Trecker Special Machinery Division representative. He'll be glad to help you with your production requirements. Call him today.

For more details on machine illustrated ask for Data Sheet No. 1062. Booklet "Doorway to a proven method for solution of big and small metalworking problems" is also yours for the asking.



KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

Special Machinery Division

MILWAUKEE 14, WISCONSIN, U.S.A.

Builders of Precision and Production Machine Tools Since 1898



FREE—New Bulletin T-1 shows, describes VAILL tube end forming machine VERSATILITY for . . .

Beading • Flaring • Flanging • Sinking
Expanding • Grooving • Threading • Reducing
Double Lap Flaring • Double Lap Flanging

on Tubing up to 6" Diam.

THE VAILL ENGINEERING CO.
131 E. MAIN STREET WATERBURY 20, CONN.

USE READER SERVICE CARD; INDICATE A-4-240-1

HOGGSON STEEL HANDSTAMPS

for EVEN...
DEEP...
CLEANCUT...
LETTERS & FIGURES



Sharp, clean impressions even after years of use! Hoggson Brand Letters & Figures Hand Stamps will not spall or mushroom. Available for numbering or lettering anything from pig iron to jewelry. 19 sizes in stock, from 1/32" to 1". Roman or Gothic. Letters 27 pcs. per set; figures 9 pcs. per set.

See your distributor or send for complete catalog

HOGGSON & PETTIS MFG. CO.
144 Brewery Street, New Haven 7, Conn.

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WORLD'S HARDEST METAL

● New, improved TALIDE METAL is uniform in quality—gives top performance on ALL cutting, drawing and wear-resistant applications. Write for Catalog 58-G. METAL CARBIDES CORP., Youngstown 12, Ohio.

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • CERMETS • HIGH TEMPERATURE ALLOYS
OVER 23 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

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You're not gambling
IF you have an ACE in the hole!

ACE DRILL BUSHINGS are always a sure bet!

• *Quality* • *Accuracy*
• *Largest Deliverable Stocks Anywhere!*

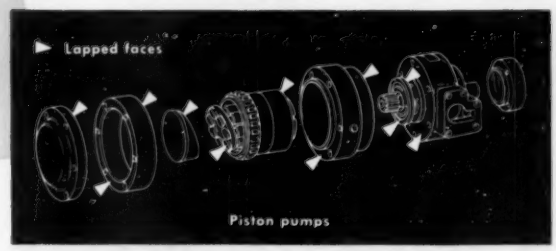
Over 22,000 sizes, types and specifications in A.S.A. and ACE standards, micro and super sizes plus bushings for embedment in plastic or castable material.

ACE DRILL BUSHING CO., INC.
5407 Fountain Ave., Los Angeles 29, Calif.

USE READER SERVICE CARD; INDICATE A-4-240-4

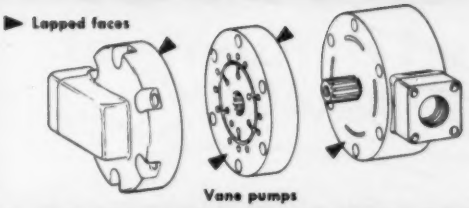
How Pump Manufacturers Use the

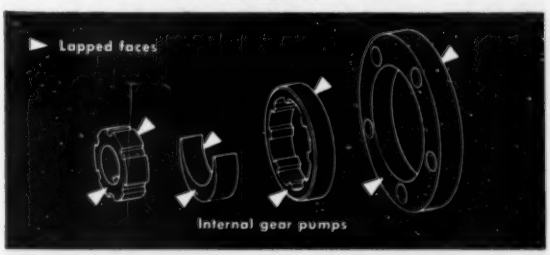
Lapmaster® To Improve Product Performance

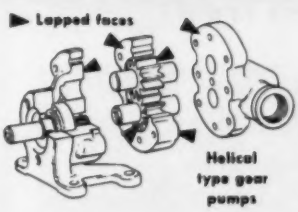


Like valve manufacturers, a large number of pump manufacturers need precision flatness and finish in order to insure efficient product performance. They're getting *both* flatness and finish plus parallelity in production quantities with Lapmasters. Photos at right illustrate a few typical parts being machined daily.

The high production accuracy of the Lapmaster (micro-inch finishes of 2 to 3 RMS—surface flatness to less than .000011" when required) is being achieved on all materials including cast iron, steel, stainless steel, magnesium, aluminum, brass, carbon, ceramics, plastics and sintered metals. It will pay you to investigate this modern precision, yet economical, method of machining.









Lapping of shoulders is easily accomplished by providing the lapping plate with annular grooves

*Protected by U.S. and Foreign Patents

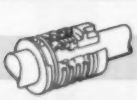
FREE TECHNICAL DATA
These three booklets will give you the facts on producing and measuring precision flatness and finish. Write for your copies today.



Crane Packing Company
6423 Oakton St., Morton Grove, Ill.
(Chicago Suburb)
In Canada: Crane Packing Co., Ltd., Hamilton, Ont.

Lapmaster® DIVISION


MECHANICAL PACKINGS

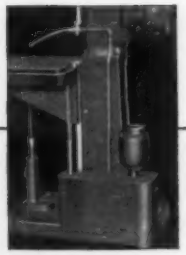

SHAFT SEALS


TEFLON PRODUCTS


LAPPING MACHINES


THREAD COMPOUNDS

CRANE PACKING COMPANY

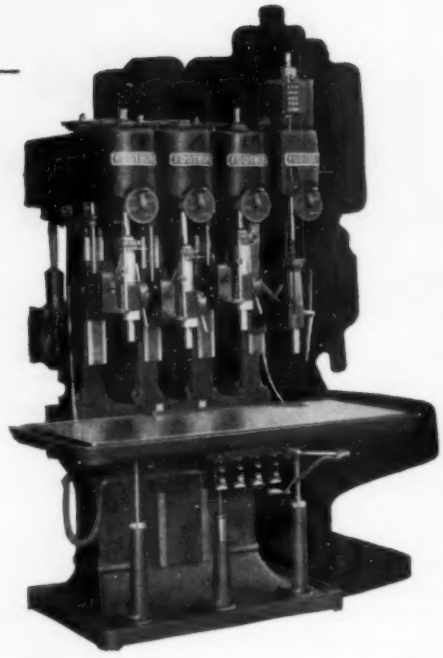


FOOTBURT

Sensitive

DRILLING MACHINES

A FULL RANGE
DRILLING MACHINE
ENGINEERED FOR
PRODUCTION



■ No. 2 Machine with Back Gear • 12" Overhang • ⅝" Drilling Capacity in Steel • Optional Speed Ranges • 185 to 2300 RPM • 280 to 3450 RPM • Vertical Motor Drive with Standard Single Speed Motor • Power Feed Assembly • Tapping Attachment • Coolant Outfit.

■ Built carefully to provide the required accuracy for fine tool room work, Footburt Sensitives are designed with the weight and stability to maintain close tolerances on day after day production work. The correct speed for a wide range of drilling, reaming, and counterboring operations is instantly available. Write for full information on this great line of Sensitive Drilling Machines. Built in 1, 2, 3, 4, 6 Spindle Models.







THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building

engineered for production

FOOTBURT

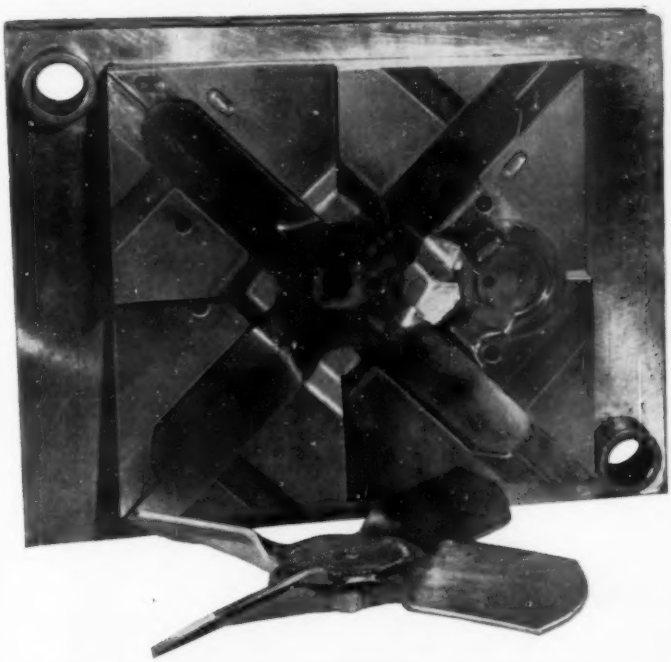
MACHINE TOOLS

Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation



They're Using Cr-Mo-W Die for Fan Hub Part

Economy and long service life were the chief reasons that led Production Die Casting Company, Houston, Texas, to select Bethlehem Cr-Mo-W tool steel for the manufacture of this hub for an attic fan.

The two-part die, with Cr-Mo-W (chrome-moly-tungsten) used for both sections, is approximately 16 in. x 18 in. The part is cast of aluminum alloy, at 1250 F. Engineers at Production Die Casting Company say, "Performance of this die has been excellent. It has provided long, satisfactory service life."

Cr-Mo-W is an ideal tool steel for applications involving drastic changes in temperature, where heat-checking and shock are a problem.

Cr-Mo-W is our general-purpose type of hot-work tool steel. It hardens in air, and has good red-hardness and good machinability. Your Bethlehem distributor carries it in stock, in sizes to meet your needs.



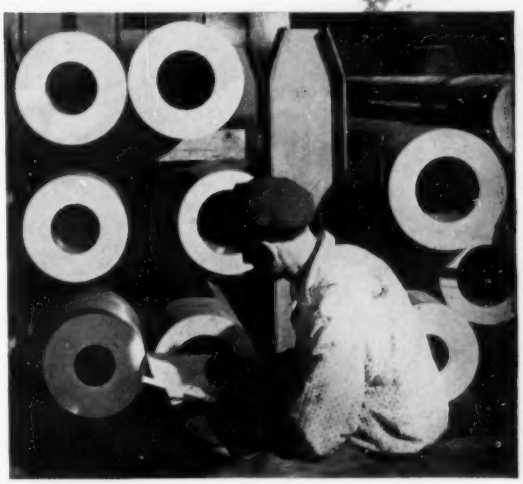
BETHLEHEM TOOL STEEL ENGINEER SAYS:

Smooth Finish in Grinding Improves Tool Life

A smooth ground finish on tools with a cutting edge is essential to good tool life. This was proved recently in an application involving the use of our Lehigh H tool steel in a rotary slitting knife.

In normal operation on hot-rolled strip these knives cut about 8000 tons per edge on the original grind. But after being reground in the mill, production dropped to about 3000 tons per edge. Investigation revealed that the reground finish was rough and coarse, which meant in effect that the cutting edges were already dulled before being used in service. When the same knives were properly reground with a smooth finish, production again averaged 8000 tons per edge.

Generally, a smooth ground finish of from 10 to 15 micro-inches on a profilometer is satisfactory for good cutting-edge performance. In the event that coarser finishes are used, you may find production decreased.



"HOLLOW-BAR" IN TWO TYPES

Bethlehem Hollow-Bar Tool Steel is now made in two types: BTR (Bethlehem Tool Room, oil-hardening), and Lehigh H (high-carbon, high-chrome). Hollow-Bar is made by a high-speed trepanning process, by which hammer-forged or hot-rolled bars are cored out, then rough-turned on the outside. Hollow-Bar is an ideal time-saver on hardened bushings, ring dies, draw-rings and the like because the steel can be put right to work. There's no need to wait for forged rings or discs.

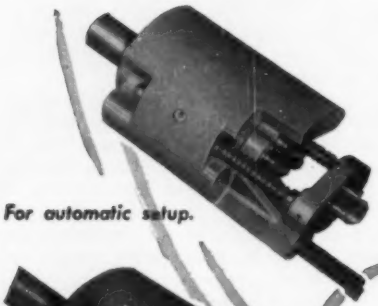


Heads...You Win!

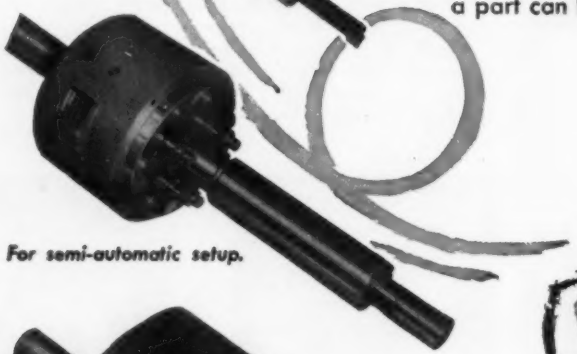
U. S. DRILL HEADS, THAT IS!

Regardless of the size of your shop, if you have high production jobs, you'll find an extraordinary reduction in tooling and manufacturing costs when you use U. S. Drill Heads.

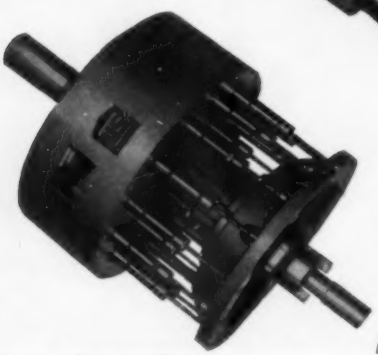
The heads shown here, moderate in cost, are for use with automatic chucking machines and turret lathes, for drilling or tapping operations. They provide, in most cases, that a part can be completely finished in one handling.



For automatic setup.



For semi-automatic setup.



For semi-automatic setup.



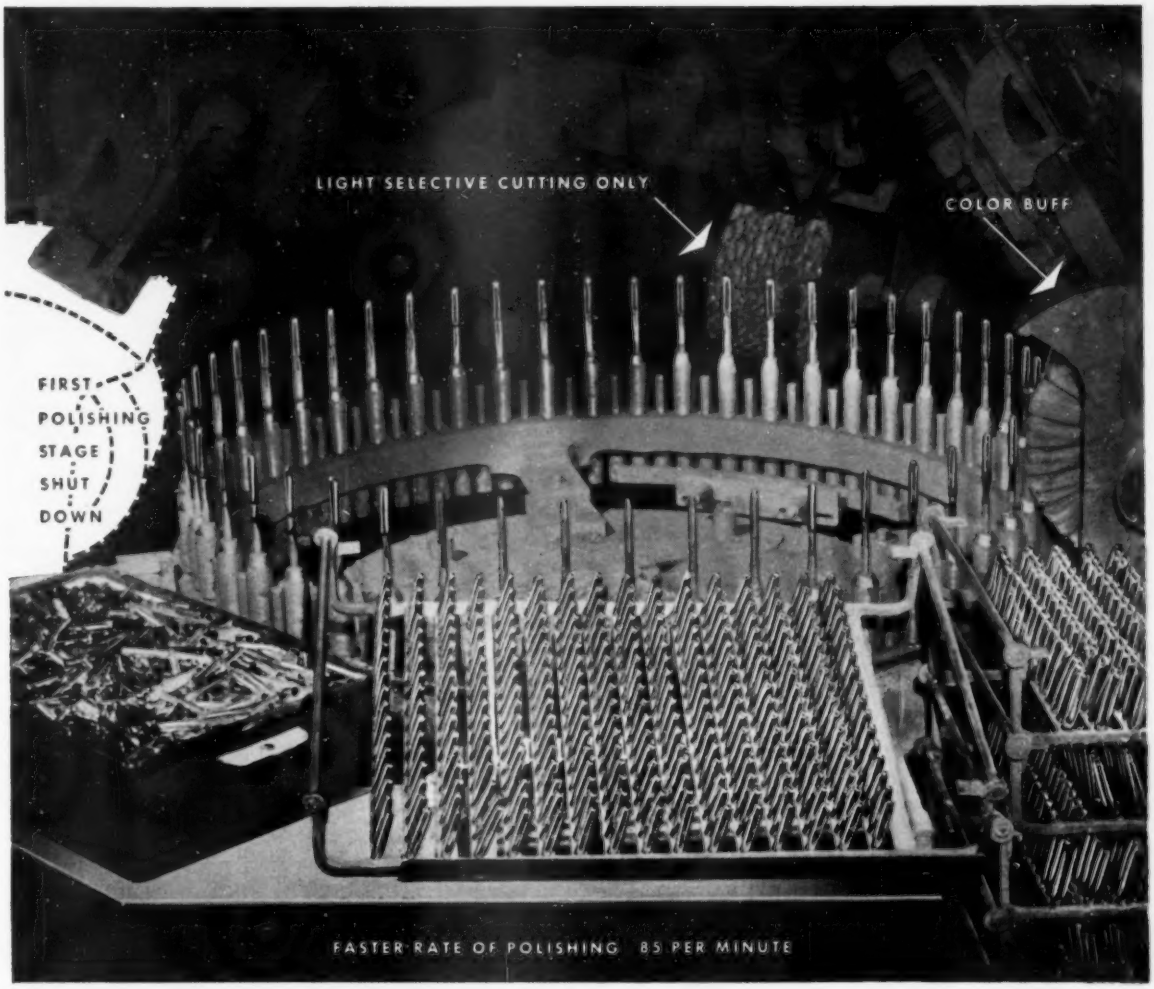
Manufacturers of all types of adjustable, fixed center and individual lead screw tapping heads.

US DRILL HEAD

THE UNITED STATES DRILL HEAD COMPANY

BURNS STREET • CINCINNATI 4, OHIO

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-244



How Formbrite cuts polishing costs 40% for JARCO



Pens, pencils, and lipstick cases have to be attractive to sell—yet they must be able to take a beating in daily use. The Jarco Metal Products Co., which specializes in drawing metal parts for these and such other products as miniature flashlight cases, and similarly formed products, tried Formbrite,® Anaconda's new drawing brass, shortly after it was announced to the trade.

Superior polishing characteristics combined with excellent drawing properties, plus hardness and scratch resistance, sounded ideal for Jarco products. Formbrite has proved an excellent pressroom material. The uniformity of temper from batch to batch eliminated shutdowns for adjustments in their battery of 12-plunger Waterbury-Farrel presses, which can produce up to 500,000 pieces a day.

It's in the polishing room where Formbrite has really paid off. Jarco uses 50- and 98-spindle continuous-loop machines having two cutting stages and a final color buff stage. The first cutting stage is shut down completely. The second stage is used for only a partial or selective cut in certain areas of the cap—because of the extremely deep draw. The color buff stage does most of the work. The savings in polishing run about 40%, according to David Roberts, vice president.

Formbrite is a premium product at a nonpremium price. Find out for yourself how its superfine grain, excellent drawing properties, strength, and scratch resistance can help you make a better product at lower cost. Write for Publication B-39. Better yet, ask about a sample or a trial batch. Write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

Formbrite
FINE-GRAIN DRAWING BRASS
an ANACONDA® product
made by
The American Brass Company

New Pangborn Hydro-Finish

solves such cleaning problems as:

* deburring
* surface finishing
* finishing threaded sections
* improving cutting tool life
* maintaining dies and molds
* removing grinding lines
* removing heat treat scale
* preparing surfaces



Pangborn has redesigned the Hydro-Finish for added efficiency and easier handling. *Originating the use of air jet sluriators to eliminate pumps,* the new Hydro-Finish represents a lower investment as well as a lower maintenance cost. Optional equipment simplifies overall operation. Investigate Pangborn Hydro-Finish now!

For full details, send for Bulletin 1403, now! Write to: PANGBORN CORPORATION, 4700 Pangborn Boulevard, Hagerstown, Maryland. *Manufacturers of Blast Cleaning and Dust Control Equipment.*

Pangborn

BLAST CLEANS CHEAPER

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-4-246-1

You Can Rely on a

ROUSSELLE



DEEP THROAT PRESS | HORN PRESS | O.B.I. PRESS | DOUBLE CRANK PRESS

THESE 40-TON PRESSES

take job after job in stride and give you top speed and uniform output on a variety of work. They stress simplicity in every detail to achieve quicker set-ups, easier changeovers and simpler operation. All are extra rugged, high precision units, made to withstand hard usage and assure long, satisfactory service. They are very moderately priced.

Significant savings may result if you let our engineering staff assist you. There is no obligation.

Rousselle Presses are sold exclusively through leading machinery dealers.

Choice of 25 models in 5 to 40-ton sizes.

Manufacturers of Rousselle Presses

SERVICE MACHINE CO.

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CHICAGO 20, ILL.

USE READER SERVICE CARD; INDICATE A-4-246-2

WESPO *for ALL*

WORK-HOLDING *needs!*



TOGGLE CLAMPS
36 Types & Sizes

Note These Features—Reamed Holes—Hardened Serrated Bushings—High Tensile Strength Rivets

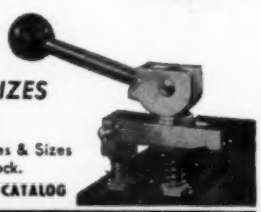
STANDARD FIXTURE CLAMPS
15 STYLES . . . 136 SIZES



COMPONENTS

Over 1000 different Types & Sizes available from stock.

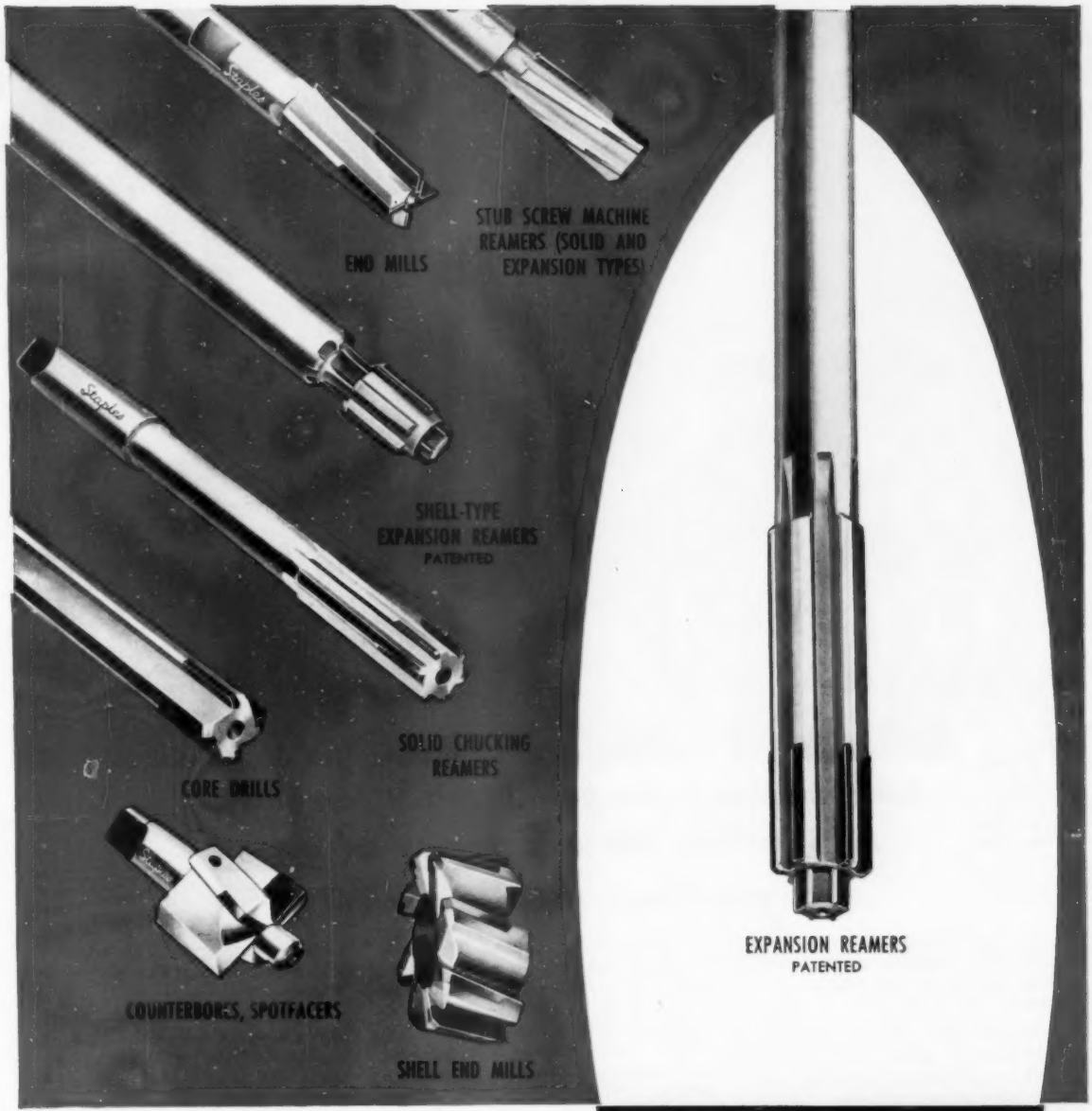
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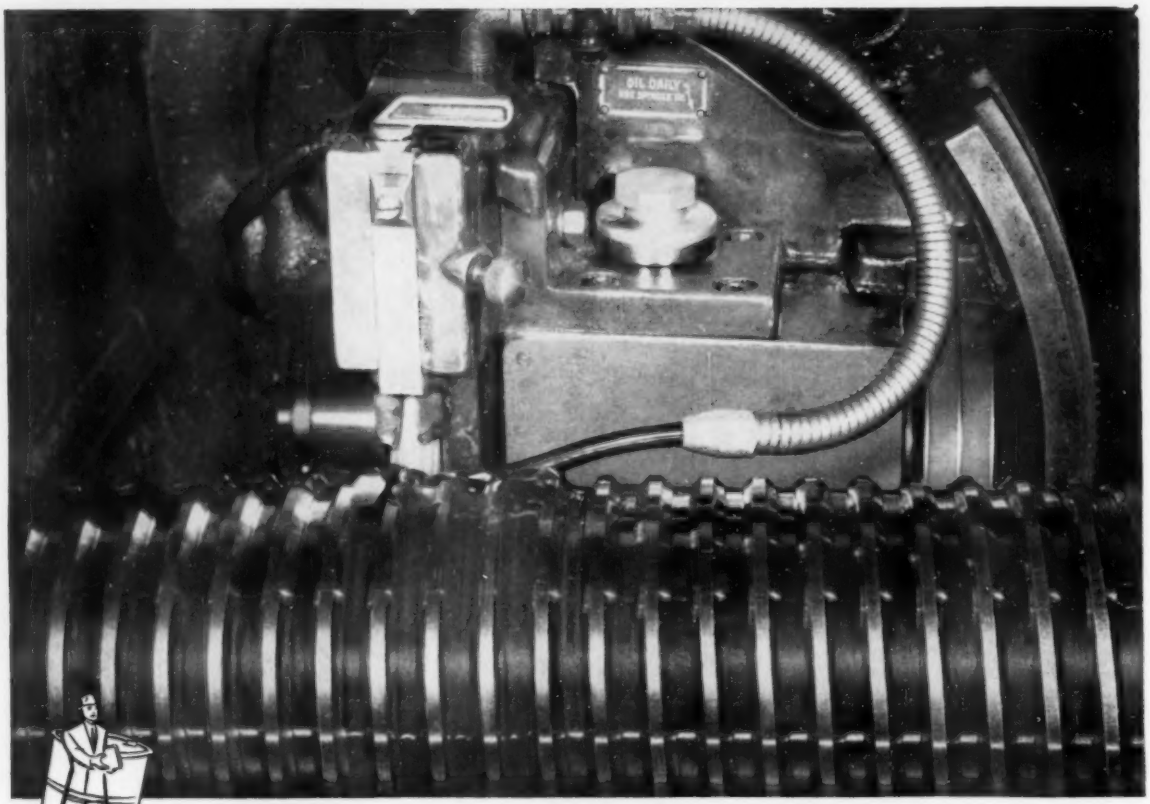
Lower Your Costs With Staples Carbide Tools

Precision and quality built into these tools results in overall economies as proven by production records.

THE Staples TOOL COMPANY
CINCINNATI 25, OHIO

Staples
ROTATING CUTTING TOOLS CARBIDE-TIPPED

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-4-247



Ask "the Man in the Barrel" to tell you how . . .

A Grinding Oil can *make* or *break* precision grinding jobs!

If you're using *just a coolant* or any oil that happens to be handy for those precision grinding jobs . . . it's costing you money!

A grinding oil can make or break a precision grinding job such as thread grinding, gear grinding and many types of form grinding. Grinding oils are usually classified as "hard-acting" or "soft-acting" depending on how they affect grinding wheel hardness. Grinding oil characteristics must be closely co-ordinated with wheel characteristics, speeds, feeds, and material machinability and hardness to obtain maximum performance.

When form grinding low hardness materials, where wheel form is important, a "hard-acting" oil helps to maintain proper wheel form by making the wheel act harder. As a result, greater wheel life is obtained and more accurate parts are produced.

When a high hardness material is being ground there is a tendency for the wheel to load-up and glaze. Such a condition is the cause of burnt work surfaces and heat checks, and is often encountered when grinding taps, gauges and other hardened parts. A "soft-acting" grinding oil will make the wheel act softer, opening up the wheel and exposing new abrasive grains to do the work.

Stuart's complete line of grinding oils have been chemically balanced and scientifically tested to meet the demands of various types of precision grinding operations. "The Man in the Barrel," your trained Stuart Representative, will be happy to assist you in selecting the proper grinding oil for your particular needs. Ask to have him call . . . and ask for a Stuart's Precision Grinding Oil Bulletin, too.

D. A. STUART OIL COMPANY, LTD.
2727-49 S. Troy Street, Chicago 23, Ill.

More than a "Coolant" is Needed



Stuart Oils

Time Tested Cutting Fluids and Lubricants

Plants in: Chicago, Detroit, Cleveland, Hartford, Philadelphia and Toronto, Ontario.

Branch Warehouses and Representatives in principal metal working centers in the United States, Canada and Europe.



For heavy duty precision drilling . . .

it's a *Jacobs* CHUCK

Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

THE JACOBS MANUFACTURING COMPANY • WEST HARTFORD, CONN.



The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.



The Jacobs Rubber-Flex® Tap Chuck for tapping heads and impact tools.



The Jacobs Ball Bearing Super Chuck for heavy duty and precision industrial use.



The Jacobs Model 96 Collet Chuck for grinding machines, millers and jig-borers.



The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.



The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.

When does surface smoothness begin to waste your money?

In most plants today when a design engineer specifies a certain finish for a part, no one in production knows whether the part will be overmachined, O. K., or too rough until that part reaches the inspection department.

By then it is too late.

The costly consequence is that the company loses money on every part finished too well, AND on every reject resulting from underfinishing. Surface finish begins to waste your money at two precise points . . . *the moment you finish a part a single microinch better than the job requires, and the moment you finish a part a single microinch worse than required.*

Surprising as it may seem, most in-process checking today consists of judging how the finish *looks* and how it *feels* because no accurate, portable, in-process checking equipment has been available. The production department had no tool that could instantly tell the machine operator when he had met the specification.



The Brush Surfindicator takes the costly guesswork out of finish control. Fully portable . . . weighs only 15 pounds.

What has been done?

Brush has developed an amazingly rugged electronic surface measuring device called the SURFINDICATOR* which can be carried anywhere in the shop to obtain an instantaneous, accurate in-process measurement of roughness on any surface – flat, round or inside-a-hole.

Now you can set up optimum specifications for surface finish based on your laboratory or pilot model tests . . . and then hand a reliable instrument to the production department to help them meet those specifications with no waste of worker or machine time. You can mount SURFINDICATORS at each machine or set up checking stations throughout the plant. And your regular machine operators can use them . . . it doesn't take an expert.

How It Works

All the user does is pass the stylus over the surface in question and take a direct reading. It's simple, fast, accurate and above all it's practical . . . for metallic surfaces and for glass, porcelain, plastic, paper and other materials.



This new booklet on the Brush Surfindicator includes the new ASA standards . . . will help you establish economical surface finish control.

You should know all about this portable device, its many, many uses and the savings it can mean to your company. We tell the whole story in a new booklet which also includes the new ASA standards on surface finish for industrial use. Write for your copy today on your company letterhead. *T.M.

BRUSH ELECTRONICS COMPANY

3405 Perkins Avenue, Cleveland 14, Ohio

BRUSH 6 ELECTRONICS

DIVISION OF CLEVITE CORPORATION

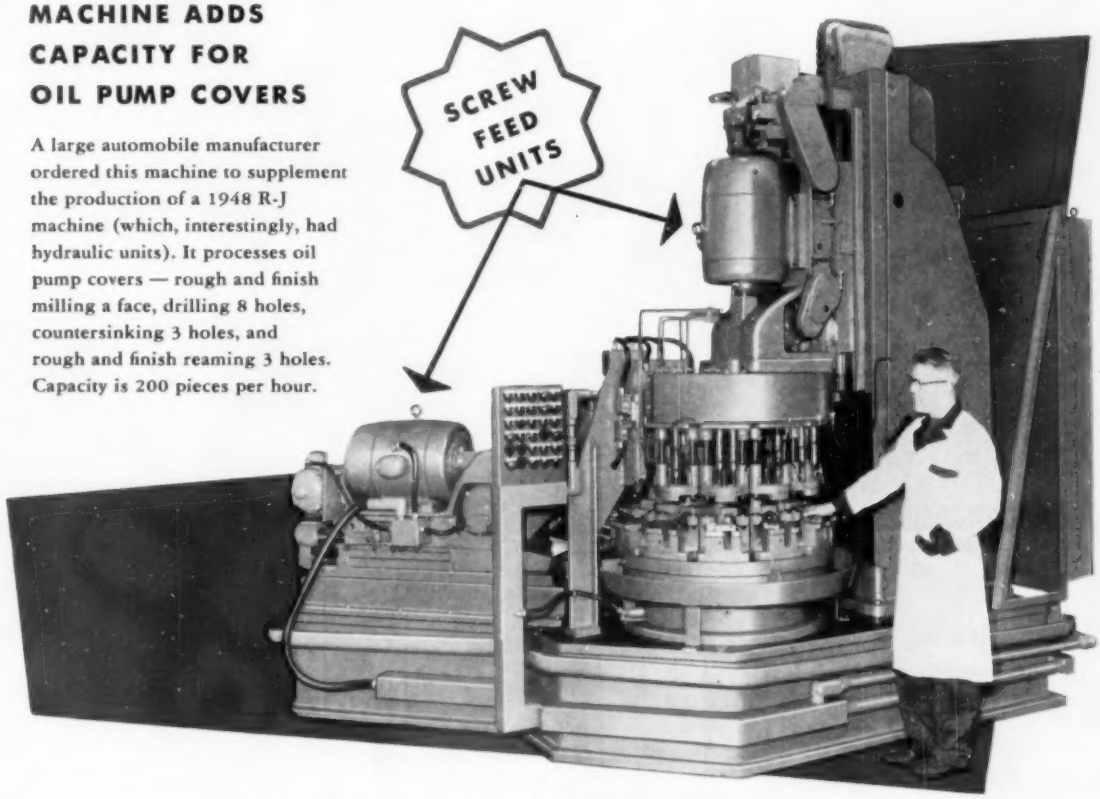
REHNBERG-JACOBSON

SCREW-FEED UNITS PROVE WORTH; "SPECIFIED" ON NEW MACHINE...

Rehnberg-Jacobson ALL-MECHANICAL Screw-Feed Power Units were carefully investigated by the potential purchasers of this machine — with the result that they *insisted* the Units be included. These Units later proved to be important factors in the final (and favorable) consideration. In many other instances, R-J Screw-Feed Units have shown that they are rugged, reliable, and — most important — *easily understood* by service and maintenance people. These Units operate on the well-proved feed screw principle, with separate motors driving differential nuts to obtain the desired approach, feed, dwell, and rapid return. An accurate and fast-acting brake is included to insure precise ending of the fast return. As can be seen from the picture, the Unit frame is large enough to carry a husky spindle-drive motor, and the face plate will hold a large multiple-spindle head. *For full details and specifications, write for literature.*

MACHINE ADDS CAPACITY FOR OIL PUMP COVERS

A large automobile manufacturer ordered this machine to supplement the production of a 1948 R-J machine (which, interestingly, had hydraulic units). It processes oil pump covers — rough and finish milling a face, drilling 8 holes, countersinking 3 holes, and rough and finish reaming 3 holes. Capacity is 200 pieces per hour.

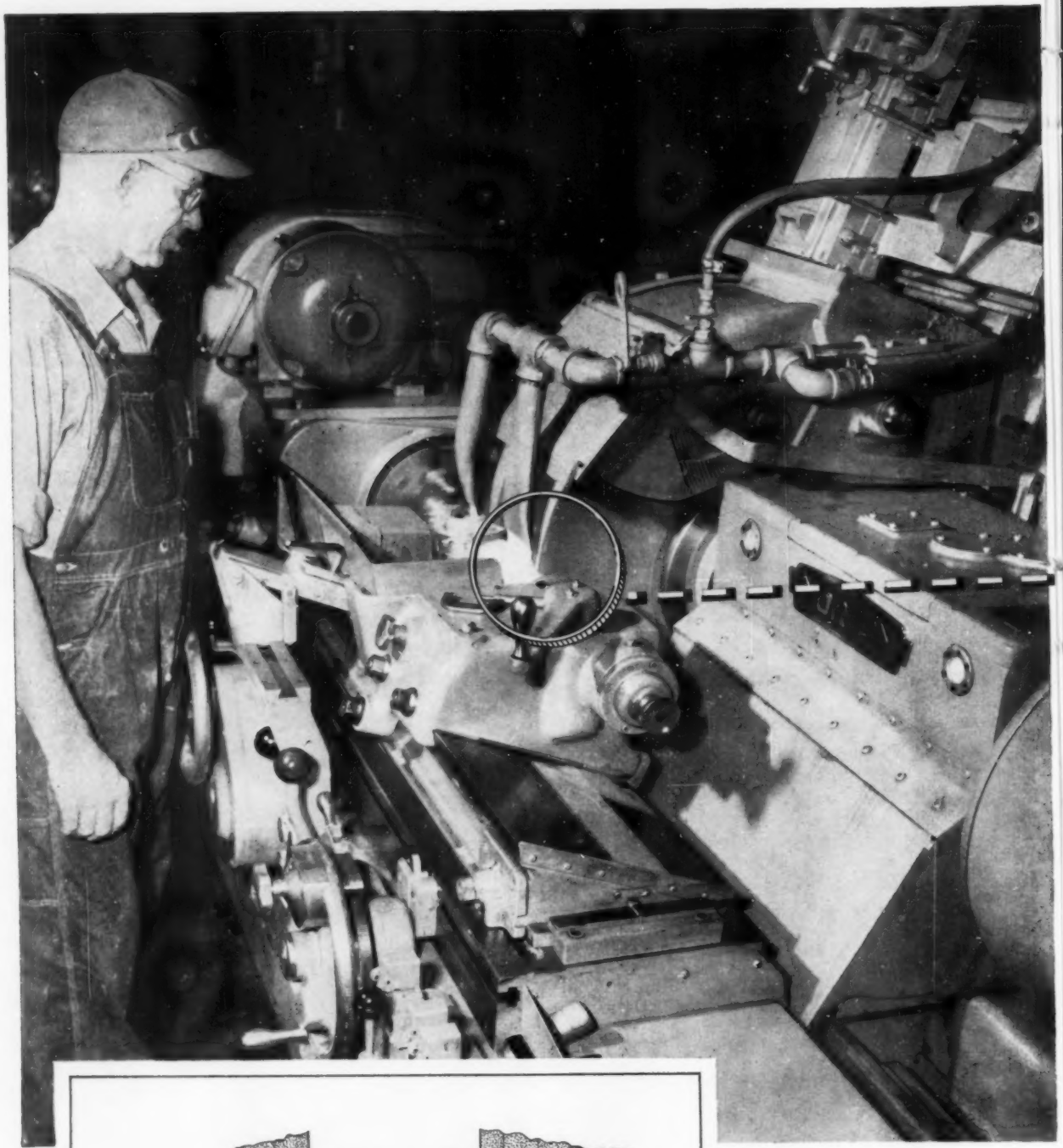


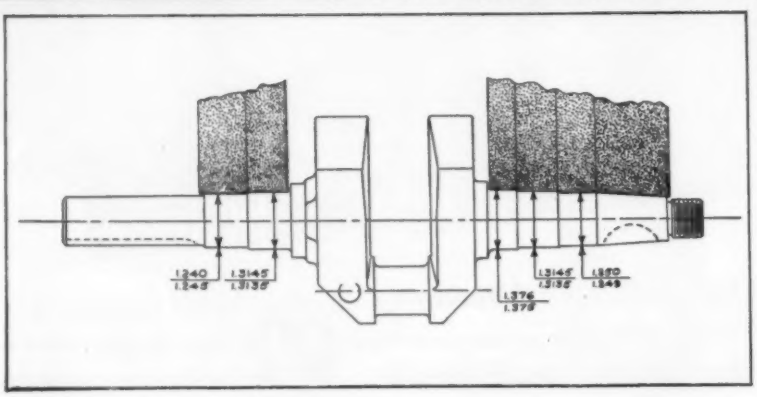
Designers and Builders of Special Machinery

REHNBERG-JACOBSON MANUFACTURING COMPANY

2135 KISHWAUKEE ST.

ROCKFORD, ILLINOIS





IN WISCONSIN MOTOR CORPORATION'S MILWAUKEE PLANT, crankshafts are ground on a Norton Type CTU-HD 10" semiautomatic heavy duty cylindrical grinder for approximately half what this job formerly cost. Diagram shows six simultaneous grinding operations: two diameters by wheel on left, three diameters and taper by wheel on right.

The "WISCONSIN STORY"...

Wisconsin Motor Corporation, leading manufacturers of heavy duty air-cooled engines, reports:



with this Norton Heavy Duty Grinder

Type CTU-HD machine in Milwaukee plant grinds crankshafts faster and better — at one-half previous cost!

Wisconsin Motor Corporation's endorsement of the Norton Type CTU-HD cylindrical grinder is echoed throughout industry. In plenty of other modern plants this highly advanced, heavy duty machine is doing an outstanding job of boosting production rates and profit margins.

A single 10" Type CTU-HD — or 14" Type LCTU-HD, with increased swing — replaces several separate old-type grinders. It accommodates multiple wheels widely spaced, making it ideal for many plunge cut operations. Or it will take large diameter wheels, essential on such jobs as grinding crankshaft bearings, in order to permit adequate wheel wear before interference with parts of the work.

Semiautomatic or Plain

The semiautomatic arrangement provides an adjustable, automatic grinding cycle under one-lever control. The operator merely loads and unloads, and so can handle more than one machine. Except for this feature the plain machine is identical, and both machines are arranged for fast traverse grinding.

Simplified Operation and Maintenance

All controls for feeds and speeds are set in front of machine. Wheel feed is by a precise revolving screw mechanism with click-count index, by which settings for .0001" in work diameter reduction can be made instantly, without visual check. Controls of work rotation and coolant flow are automatic. Pumps, motors, filters, relief valves, ways lubricant control valves are all outside, for easy maintenance.

For Complete Details

see your Norton Representative or write us direct. And remember: only Norton offers you such long experience in both grinding machines and wheels — your assurance of the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

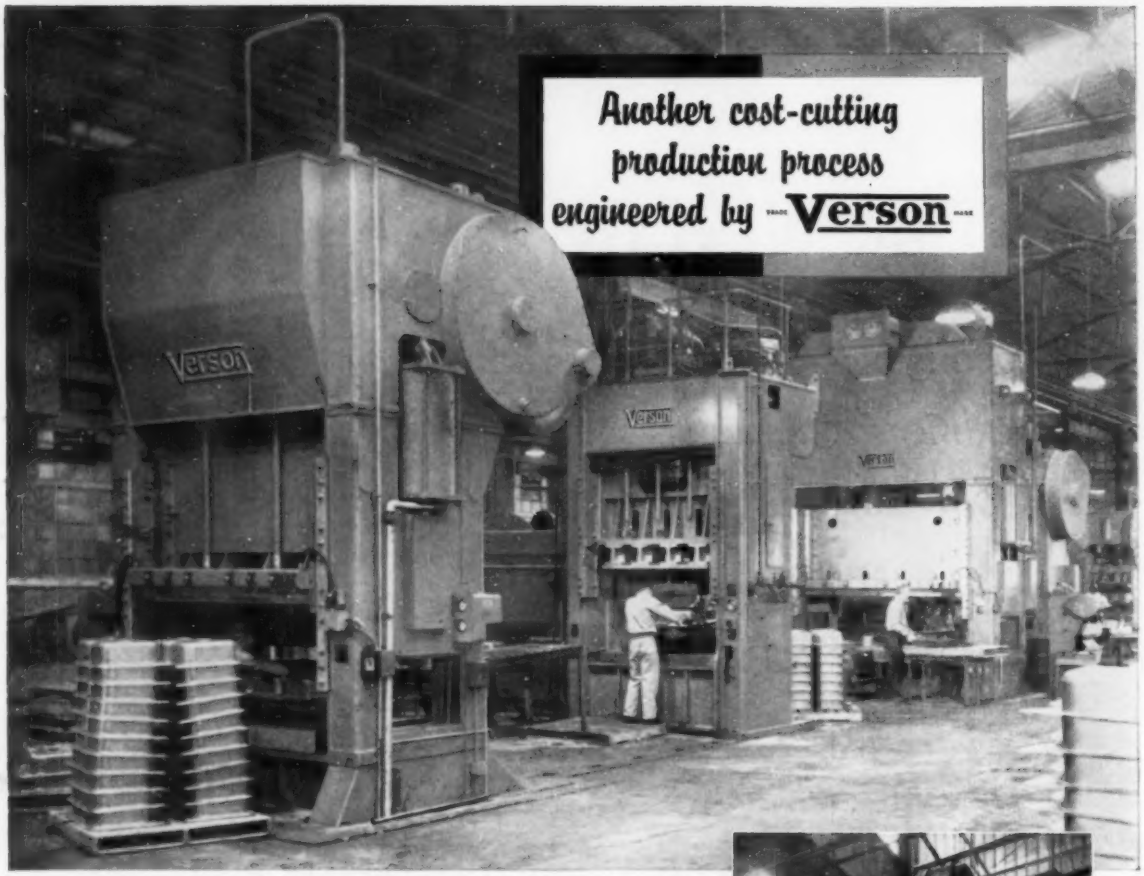
***To Economize, Modernize with* NEW**

NORTON

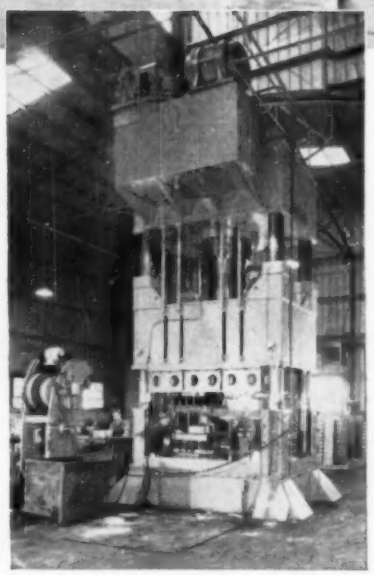
GRINDERS *and* LAPPERS

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This Verson line-up cuts costs on double sump sinks



● The press line illustrated above, part of the final operations in forming double sump sink units before porcelain enamelling, includes Verson eccentric, hydraulic and crank presses. Previous operations on the sinks include deep drawing the sumps to a depth of 7⅜" from 14 gauge Armco deep drawing stock on a 1000 ton Verson hydraulic press and piercing and embossing the center drain hole in the sinks on a Verson O.B.I. Both of these presses are shown at the right.

This is more than just a line-up of Verson presses . . . it's a production process engineered by Verson to cut costs as an integrated part of the complete manufacturing program. Verson has the experience and facilities to meet the most exacting press requirements . . . and the "know how" to blend these presses into an efficient and practical production process.

Put Verson facilities to work for you. Send an outline of your production requirements.

A Verson Press for every job from 60 tons up.

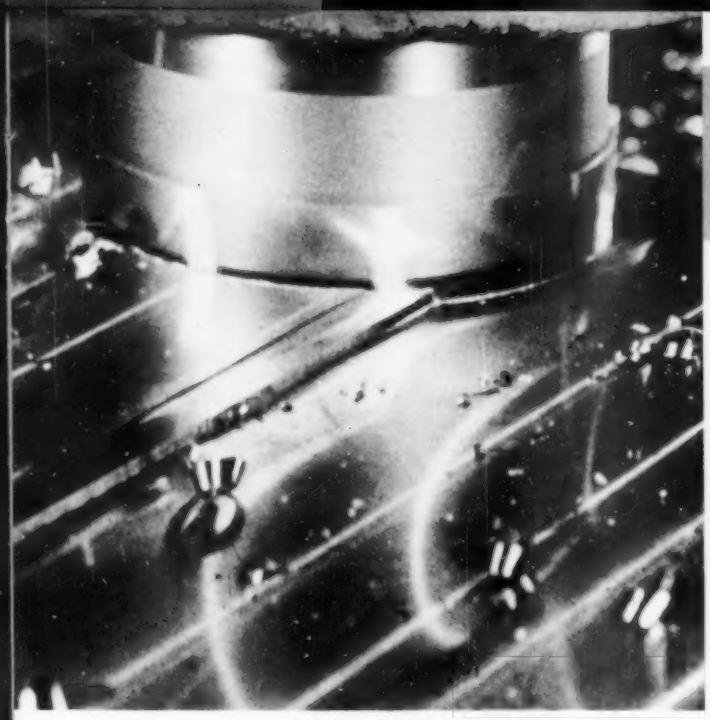
Verson

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carbide NEWS

WESSON development cuts tool costs, down time and inventories in milling and boring

Throw-Away Insert Milling Cutters Eliminate All Grinding

A revolutionary new approach to carbide milling has been developed and is announced by Wesson Company, Detroit, with the introduction at the Tool Show in Chicago of Wesson Throw-Away insert milling cutters. These cutters, which like Wesson Throw-Away insert holders never require sharpening, are designed to handle the majority of all rough and finish milling operations on cast iron and steel.

Employing low-cost disposable Wessonmetal blades have eight quickly indexible cutting edges, the Wesson Throw-Away insert milling cutters provide a broad range of advances in milling practices. Following are some of the characteristics:

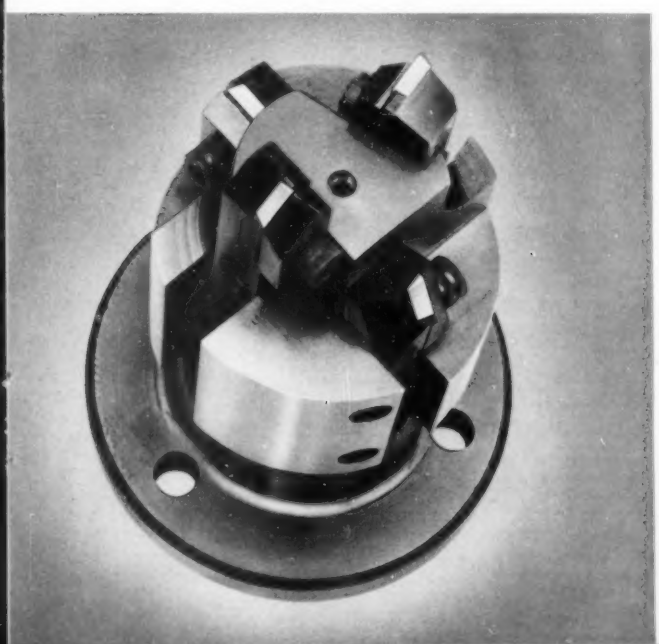
1. **High Speed Milling**—The design of the throw-away insert milling cutter permits high speed milling at high feeds. Negative radial and axial rake combinations provide ample clearance and give eight cutting edges on square blades.

2. **Low Tool Cost**—Blade cost is as little as 17 cents per cutting edge. By elimination of grinding, cost per piece is lower.

3. **Quick Setup**—Elimination of grinding and any need for complicated blade adjustment make rapid blade indexing possible, resulting in drastic reduction in set up time.

4. **Inventory Reduction**—Since cutters do not have to go back to cutter grind for re-sharpening, excess reserve inventory of cutter bodies is not required. Cutters, in some cases, can be maintained right at the machine. Efficient milling of both cast iron and steel, possible with the same cutter body using different carbide grades, also reduces inventory costs.

(continued on page 2)



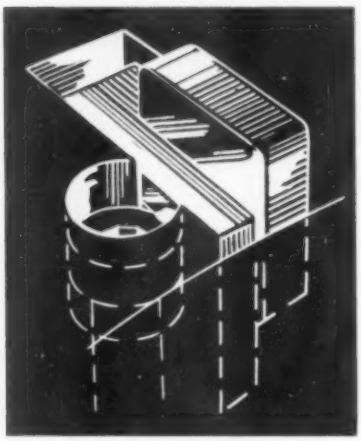
Throw-Away insert boring tools were the second step in Wesson's evolution of a complete throw-away tool line. In use for more than a year these boring tools helped prove the applicability of the throw-away principle to multiple point and rotary tools.

Throw-Away Insert

(*Continued from page 1*)

5. Standard Drive—In addition to their many advantages, Wesson Throw-Away Insert milling cutters can be used with present adapters and machines eliminating special conversion cost.

If you missed this revolutionary new development at the Tool Show or saw it and want more details, write Wesson today for complete illustrated literature. Ask for Bulletin WC-356.



Assembled view of Throw-Away insert milling cutter blade, locking wedge and socket head screw shows rigidity achieved by full face bearing of the hardened steel locking wedge on the solid carbide tip.

New Holders Designed for Offset Machining

A new line of indexible carbide insert tools for offset turning and facing has been added by Wesson. Available in four sizes and right or left hand offset styles, holder models GAR and GAL are listed as semi-standard tools by the company.

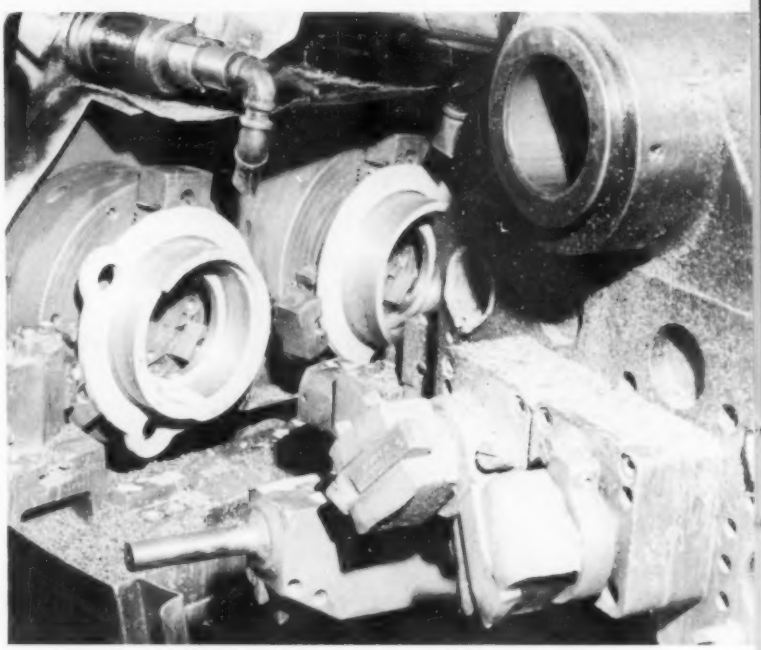
Extensive field tests have proved the economy of the indexible insert offset holder over conventional offset tool types in reduced changeover time.

Ask for Bulletin GAR-GAL to get additional details of the new holder line.

tools Wesson carbide Wessonmetal

WESSON COMPANY DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA: WESSON CUTTING TOOLS, LTD.
93 LEICESTER AVE., TORONTO 18, ONTARIO

Carbide Insert Tooling Slashes Machining Costs, Boosts Output



Output of final drive pinion bearing cages jumped from 40 to 400 per grind after change to solid carbide insert holders.

Production of tractor final drive pinion bearing cages jumped from 40 to an average of 400 pieces per grind and tool cost per piece dropped from $0.19 to $.0034 when a midwestern builder of road machinery switched to carbide insert-type holders at two stations on rough and finish machining operations. Wesson tools are used at all stations.

Rough and finish turning, facing, boring and chamfering of the bearing cages are performed on a 25 hp two spindle Potter & Johnson automatic turret lathe in five operations with two bearing cages being machined per set-up. The new insert-type tooling on four positions at stations #2 and #4, and brazed-type single point tools on all other positions use Wessonmetal Grade GS for roughing and Grade GI for finishing.

Average depth of cut for all roughing operations is ⅛". All roughing and finishing operations are being done in three feeds—.008", .012" and .018". Speeds used are 220 sfm for roughing and 380 sfm for finishing.

New No-Grind Tool Holder Bulletin Issued

Advantages and mechanical features of the new Multicut series of Throw-Away insert tool holders are described and illustrated in Bulletin No. 5510-M available from Wesson. Sketches and photographs are used to show holders, principal components and typical operations in which each of the six basic styles of holders are used. All holders are available from stock for either right or left hand use.

Separate tables for each holder give the sizes available, shank dimensions, prices of the holders only, insert catalog numbers and insert dimensions.

A large, illustrated composite table gives detailed information on the anvil locators, carbide tipped and steel clamps, taper head screws and clamp locking screws used with the various sizes and styles of the new Multicut holders. Also included are illustrations and tabular information on the standard round, square and triangular Wessonmetal Throw-Away inserts used with the various holders.

SINTOX®

CUTTING TOOLS

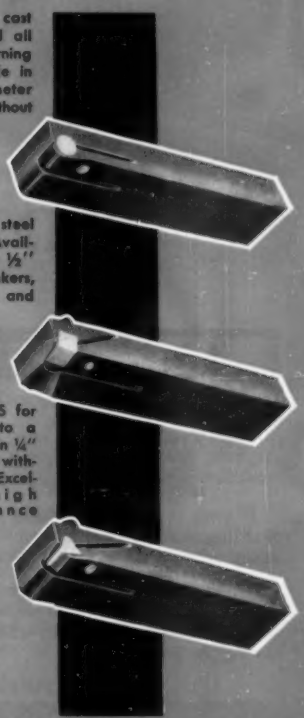
the hardest—the strongest
top performance at all speeds

The amazing, New, ceramic development...

THE GEM OF ALL TOOLING

WHY?

- *simplicity*
- *versatility*
- *availability*
- *efficiency*
- *economy*



ROUND TOOLS for cast iron, non-ferrous and all general purpose turning and facing. Available in ⅜" and ½" diameter both with and without chipbreakers.

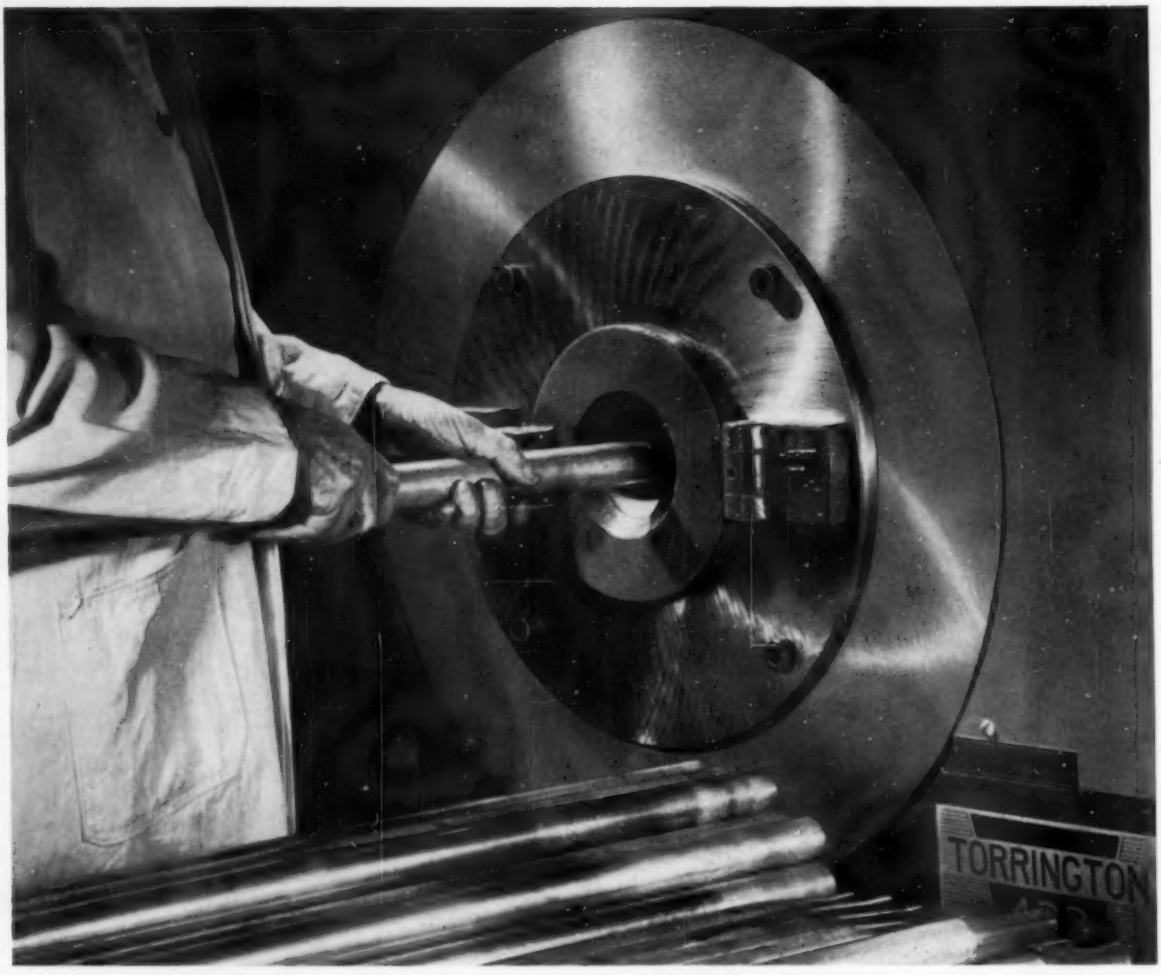
SQUARE TOOLS for steel turning and facing. Available in ⅜" and ½" square with chipbreakers, chip control grooves and plain.

TRIANGULAR TOOLS for turning or facing to a shoulder. Available in ¼" and ⅜" I.C. with or without chipbreakers. Excellent for extremely high finish, close tolerance work.

CUTTING TOOLS AND HOLDERS NOW AVAILABLE IN ANY QUANTITY

SINTOX CORPORATION OF AMERICA

270 EAST HAMILTON STREET • ALLENTOWN, PENNSYLVANIA



ROTARY SWAGING

is fast and economical



A wide variety of work can be performed by Torrington Rotary Swaging Machines—with unusual speed and economy.

The swaging time to shape this section of 1½" tubing is only 6½ seconds. And the operation is easily and accurately performed by unskilled labor.

If your operations include reducing, tapering, pointing, sizing, bonding, forming inside contours or threads—rotary swaging offers many advantages over other methods.

Write today for our informative booklet on Torrington Rotary Swaging Machines. Or even better, ask to have a technical representative call to show you where rotary swaging can achieve new savings in your plant.

THE TORRINGTON COMPANY
Swaging Machine Division
444 North Street, Torrington, Conn.

Advantages of Rotary Swaging—

1 **Savings in material**—swaging is chip less—shapes the work instead of cutting metal away.

2 **Saving in labor**—swaging can be done by unskilled labor.

3 **Improved products**—swaging improves grain structure, tensile strength, resiliency and finish. Produces work accurate to ± .001" and better.

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Torrington Job-Tested Swaging Dies—for the best in swaging machine dies—at economical prices, contact Torrington. All Torrington dies are job-tested before shipment.

THE TORRINGTON COMPANY 90th ANNIVERSARY 1866–1956

TORRINGTON ROTARY SWAGING **MACHINES**

Makers of Torrington Needle Bearings

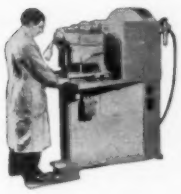


YOU CAN COMPETE with the biggest on...

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- NOTCHING
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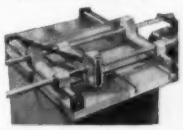
...if you'll Sharpen Your Pencil the "WALES-WAY"

Competition gets a bit rough on big production jobs... particularly when the bid calls for an extra sharp pencil. Some of the big shops, with their modern equipment, plenty of space, ample resources, make it tough for the small shop... UNLESS...



THE WALES FABRICATOR

Yes, there IS an answer to the problem. Give some careful attention to the WALES FABRICATOR... one of the speediest, and most accurate machines ever produced for fast PUNCHING and NOTCHING, for NIBBLING and for every day competitive work.



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Used with the WALES FABRICATOR, this equipment accurately duplicates holes quickly, easily and without costly dies, plates, attachments and set-up time. Put your Templet in the DUPLICATOR. Put your production piece in the WALES FABRICATOR. Press LOCATOR-PIN of DUPLICATOR gently and a microswitch activates the FABRICATOR. Another 'WALES-WAY' for extra profits.



WALES HOLE PUNCHING UNITS

These Units are self-contained, permitting unlimited patterns without custom built 'fixed' dies for each new pattern. Run one pattern, the same Units may be used with other patterns, over and over again. No dead storage of set-ups. No heavy investment in tooling equipment. Turn out MORE WORK. Bench assembly... reduces press down time. These are but a few of the machines, tools and equipment in the 'WALES-WAY' to bring your shop a step ahead of any competition.

FREE ENGINEERING ANALYSIS

The WALES Engineering staff will be happy to bring the complete story to your shop. They'll survey your work and show you how to save money and make *more profit*. No obligation, of course.



Send for BULLETIN No. 12C.

These FOLDERS contain interesting information, descriptions and examples of work done the 'WALES-WAY'

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Engineered with the quality features that make end milling jobs pay off

Engineered with the hardest practical grade of carbide to "breeze" through the toughest metal cutting applications.

Nelco end mills are precision ground all over—from shank to cutting edge.

174 different end mills—diameters from ¼" to 5"—2, 3, 4, or 6 flutes—straight or taper shank—a tool for every application! Specific cutting angles are engineered for each size and series of tools assuring smooth, prolonged performance on all materials. Primary and secondary clearance angles on the carbide produce the strongest cutting edge ever devised with clearances sufficient to operate at high speed.

The complete Nelco end mill line means a tool for *every job*—from stock—without the delay and cost of a "special".

Your equipment relies on its tooling for production—and in *any* machine—new or old—Nelco carbide tipped tools really PRODUCE!

Send today for the new Nelco catalog—over 850 tools. 850 ways to better production at less cost.



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2 FLUTE CARBIDE TIPPED END MILLS
•
2 FLUTE SOLID CARBIDE END MILLS
•
3 FLUTE CARBIDE TIPPED END MILLS
•
4 FLUTE CARBIDE TIPPED END MILLS
•
4 FLUTE SOLID CARBIDE END MILLS
•
5 FLUTE CARBIDE TIPPED END MILLS
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6 FLUTE CARBIDE TIPPED END MILLS
•
TYPE C SHELL MILLING CUTTER ARBORS
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FORGED TOOLS

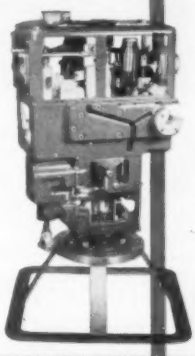
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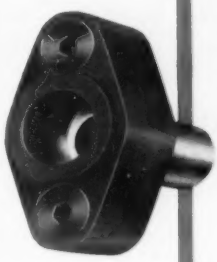
NELCO TOOL CO., Inc. • Manchester, Connecticut

5 practical ways to "streamline"

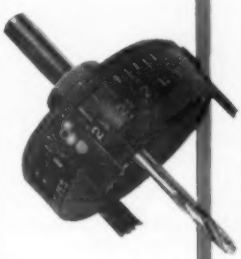
...without sacrificing fastening strength



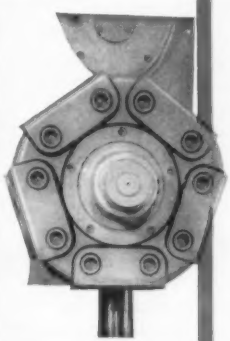
1. Counterbored holes are the simplest approach to flush surfaces using standard socket cap screws. The advantage of specifying genuine Allen ○ Head Cap Screws is the greater strength of Allenoy steel... you can use smaller sizes for closer spacing and reduced weight. Call on Allen, too, for *very large* socket-head, precision cap screws — up to 2½ inch diameter.



2. Countersinking enables you to get absolutely smooth external surfaces using Allen ○ Flat Head Cap Screws. Allen ○ Cap Screws feature the exclusive Leader Point which makes screw starting easier and guards against thread damage.



3. Button Head Cap Screws produce snag-free unbroken surfaces where countersinking is impractical. Button-head hex sockets are necessarily shallow. In genuine Allen ○ Button-Head Cap Screws, sockets are cold forged without broaching, in extra strength Allenoy steel... essential protection against stripping the sockets under high torque pressure.



4. A ready made hole tapped in forged steel solves many a design problem. It's called the Allenut. It can be anchored in soft material to assure durable threading, or recessed to permit tightening with an Allen Hex Key.



5. Bright finish, or rust and corrosion resistance call for Allen ○ Stainless Steel Cap Screws. They are standard stocked items (both NF & NC threads) readily available in a wide range of sizes from Allen Distributors.

YOUR ALLEN DISTRIBUTOR can give you practical help and swift service. For complete information on any technical fastening problem, write our engineering department direct.

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MANUFACTURING COMPANY

Hartford 2, Connecticut, U.S.A.

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For Grinding—Higher Production and Chatter-free Quality

IRD Analyzers did this for Timken Roller Bearing Company:

1. Cut unproductive downtime for wheel balancing by 600%.
2. Eliminated grinder chatter—no chatter rejects.
3. Decreased troubleshooting time by pinpointing *all* the causes of chatter.

What's more, in-place electronic wheel-balancing eliminated removing the grinding wheel from the machine—cutting wheel balancing time from 3 hours to less than 20 minutes. Not only do IRD Vibration Analyzers locate and correct trouble in grinding wheels, but in accessory components such as spindles, motors, belts, gears and hydraulic systems. The IRD Analyzers are portable for troubleshooting and in-place balancing... *at running speed.* Now, no grinding machine at Timken exceeds the permissible vibration tolerance of .000090 inches.

What IRD troubleshooting equipment is doing for Timken, it can do for your company's production equipment... for any machine tool, or for fans, pumps, motors, turbines, generators... machinery of *any* size that has rotating parts.

Why not have an IRD representative call on you to demonstrate the possibilities of obtaining IRD Balance—final dimension of precision—on your machines?



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MAYLINE

MAYLINE Metal Plan Files Intermember and Interlock!



All Mayline metal plan files intermember and interlock. Reinforced corners permit units to be stacked safely.

Drawers operate on ball bearing rollers and are equipped with attractive grey vinyl coated dust covers.

For information about stacking with files you now have, check dimensions shown in folder S-20, or write factory.

MAYLINE

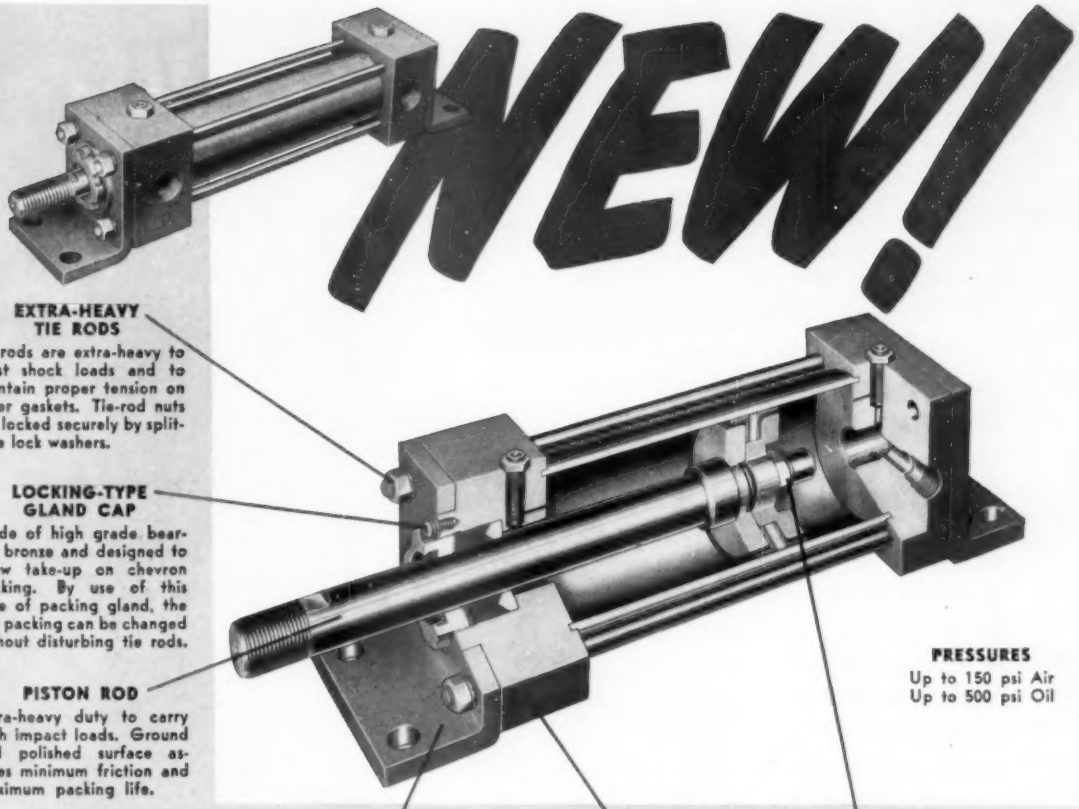


Symbol of Superiority

MAYLINE CO.
611 No. Commerce St.
Sheboygan, Wisconsin

MAYLINE

USE READER SERVICE CARD; INDICATE A-4-262-3



Logan Ultra-mation cylinders

FOR AIR OR OIL SERVICE

Designed for durability and peak performance. In your plant or on your product, with Logan you get fast-acting, positive-controlled power. Wherever there's need for air or hydraulic cylinders, there's a Logan model to give maximum efficiency. Get the facts from your nearby Logan representative or write direct. Specify Logan, your dependable "Single Source" for air or hydraulic equipment.

SAVES TIME · Logan · AIR AND HYDRAULIC EQUIPMENT · EFFORT-MOTION

Logan

MEMBER: Natl. Mach. Tool Builders' Assn., Natl. Fluid Power Assn.

YOUR DEPENDABLE "SINGLE SOURCE" FOR AIR OR HYDRAULIC EQUIPMENT

LOGANSPORT MACHINE CO., INC.
839 CENTER AVENUE
LOGANSPORT, INDIANA

Please send me a copy of your new Ultra-mation Cylinder Catalog No. 100, Section 5-1.

Name_____ Title_____

Company _____

Address _____

_____

SPECIAL RETAINER PLATES...

Punch Answers for Piercing Problems

On many punching operations, close center to center hole spacing in work and extremely fine tolerances must be held. R-B makes special retainer plates that will hold punches and die buttons exactly to your spacing specifications.

Any shape, size or number of punches and die buttons can be incorporated in the designing of your special R-B retainer plates. Also, ball locks are built into each special retainer to provide the same quick radial and vertical locking of punches and die buttons found in standard R-B retainers.

Special R-B retainer plates are made of tool steel which is precision ground after hardening. You will save skilled man hours in die construction and maintenance by using these multiple hole retainer plates. Result—more work completed each day and increased profits for you.



4953

Use R-B Engineering Service for your Tough Piercing Problems

RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
DEPT. 80 • 12667 BURT RD. • DETROIT 23, MICHIGAN



Please send me additional information.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

ALSO PRODUCED IN OTHER ALLIED PLANTS

SPECIAL COLD FORGED PARTS

FERROUS POWDERED METAL PARTS

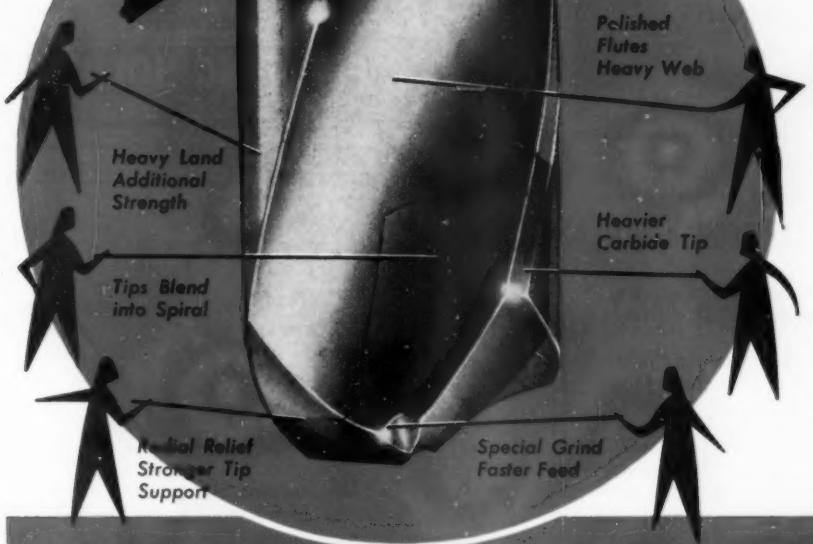
STANDARD CAP SCREWS

PRECISION GROUND PARTS

SHEET METAL DIES MADE OF FERROUS ALLOYS, ZINC ALLOYS OR PLASTICS

For Every Carbide Drilling Application There's a STANDARD SUPER DRILL

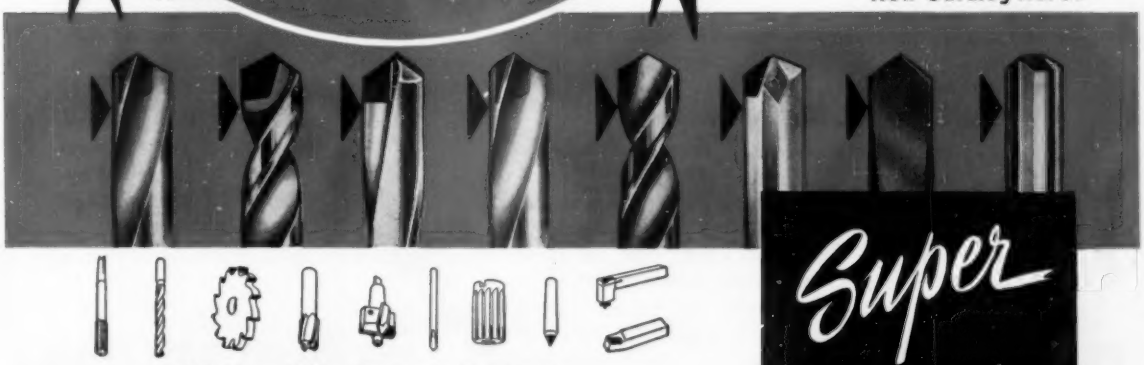
NEW and really super!



Six points of superiority— Result of two years' research. Extensive tests indicate it's the most durable and the fastest cutting carbide twist drill developed to date. Feeds as high as 8" per minute in cast iron have been obtained. Stocked in fractional, wire and letter sizes for your convenience.

NEW LOW PRICES

Write to Dept. 328 for New Catalog No. 56



Subsidiary of Van Norman Industries, Inc.

Super TOOL COMPANY

21650 Hoover Rd., Detroit 13, Michigan • 5210 San Fernando Rd., Los Angeles 3, California



For Quality Socket Cap Screws Look for the Bristol Diamond Knurl

The Bristol Diamond Knurl is the sign of a quality socket cap screw. It high-lights the overall care we take in producing these screws.

Everything about them has to be just right — or they don't pass our quality-control inspectors. As a result, every Bristol cap screw spins easily into place, fits perfectly and wrenches up tightly — so tightly that shock and vibration will never loosen them.

Ask your industrial distributor for the Bristol Diamond Knurled Cap Screws. He's got them in sizes from No. 0 and up in alloy and stainless steel. Most sizes are carried in stock for immediate delivery.

A.5.2

Precision Socket Screw Manufacturers Since 1913



*Made in sizes as small as No. 0 in Alloy Steel and Stainless Steel. Cap Screws up to 1½"

BRISTOL'S

BRISTOL'S SOCKET SCREWS

THE BRISTOL COMPANY, Socket Screw Division, Waterbury 20, Conn.

USE READER SERVICE CARD; INDICATE A-4-266-1



Speed up SET-UPS!

On tapping and reaming jobs, the Ziegler Tool Holder speeds the making of set-ups because it automatically compensates for alignment inaccuracies, even though they amount to as much as 1/32" on the radius or 1/16" on the diameter.

This is why it is extensively used in shops which keep detailed records of everything that seriously affects production costs. It converts costly set-up time into profitable production time.

The man hours a Ziegler Holder saves will pay for it several times over in a short time. Investigate and see for yourself!

Prompt Delivery

W. M. ZIEGLER TOOL COMPANY

13574 AUBURN DETROIT 23, MICH.

Ziegler ROLLER DRIVE **FLOATING HOLDER** for Taps and Reamers...

WRITE FOR CATALOG

USE READER SERVICE CARD; INDICATE A-4-266-2

GAMMONS REAMERS ★

Originators and Manufacturers of Helical Reamers and End Mills



Helical Taper Pin Reamers Shipped by Return Mail

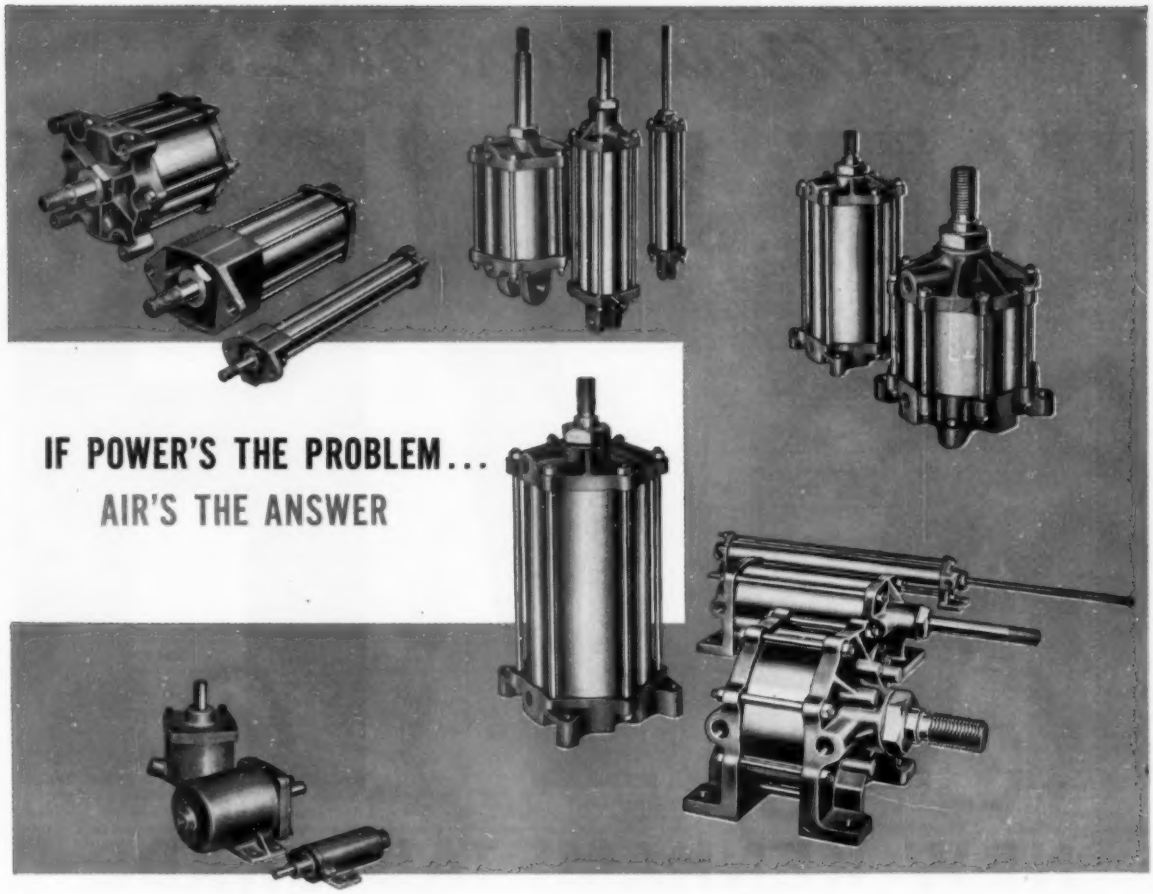
The

GAMMONS-HOAGLUND

Company

400 Main Street, Manchester, Conn.

USE READER SERVICE CARD; INDICATE A-4-266-3



Let Schrader air cylinders do the work

There is a Schrader Air Cylinder with power enough to meet any application. Ideally suited to pushing . . . pulling . . . lifting . . . lowering . . . wherever repetitive operations are required —Schrader Cylinders are used in innumerable applications in industries of all types.

Schrader has a complete line of cylinders that will meet any requirement. They are available in single or double acting, in bores up to 8" diameter, in any stroke, and in any type of mounting.

Schrader Air Cylinders will deliver controlled low-cost power to eliminate manual effort and for incorporation in automation designs. They make hard work easy and speed up production.

Don't forget, the complete Schrader line includes operating and control valves of every type, as well as all other compressed air accessories for air systems.

Write for Schrader Cylinder Specification Data or for information on the complete line of compressed air accessories.

Schrader
REG. U. S. PAT. OFF.

LEADERS IN AIR CONTROL SINCE 1844



The complete Schrader line of pneumatic accessories includes everything you need

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
462 Vanderbilt Avenue, Brooklyn 38, N. Y., Dept. B-4

I am interested in more information on_____

Name_____ Title_____

Company_____

Address_____

Announcing...

K7H

NEW KENNAMETAL* GRADE FOR HIGH VELOCITY MACHINING

Grade K7H is the hardest Kennametal ever offered for steel cutting . . . 93.5 Rockwell A. This high hardness, combined with exceptional strength—even at higher temperatures—provides a long-wearing, "balanced" cutting edge for high velocity machining at light to moderate feeds.

K7H was developed after months of cooperation with machine builders to match ever-increasing spindle speeds with the best possible cutting material for finishing operations. It is especially suited for facing, profiling, turning and boring steel alloys, high-tensile steels and "hard-to-machine" jet engine materials such as Inconel, 400-series stainless and nickel base alloys.

In tests on high-tensile steel, operating at ⅔ higher speed and 50% heavier feed, Kennametal Grade K7H consistently shows two to three times more life than the many other carbides and cutting materials that were tested.

K7H is only available in Kendex throw-away type inserts. Why not have a Kennametal tool engineer help you take full advantage of this remarkable new grade. Call him today or write, KENNAMETAL INC., Latrobe, Pennsylvania.

CHARACTERISTICS OF GRADE K7H

- High wear-resistance
- Maximum crater-resistance
- High strength in relation to hardness
- Retains strength at higher temperatures
- Ideal for high velocity cutting

Remember,
it's a Carbide . . .
it's Kennametal . . .
it's available now

*Registered trademark

INDUSTRY AND KENNAMETAL
. . . Partners in Progress

over 8,000 Different Cylinder SELECTIONS—

Miller

AIR AND HYDRAULIC

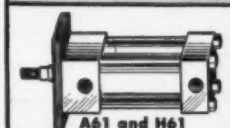
CYLINDERS AND BOOSTERS

"IN STOCK" for immediate delivery..

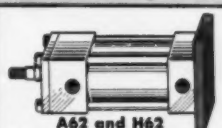
See Miller Bulletins A-105K (Air) and H-104K (Hydraulic) for Complete Dimensions and Engineering Data on these "in-stock" sizes and other Custom Miller Cylinders in bores up to 20" and strokes up to 22 feet.

"IN-STOCK" MODELS

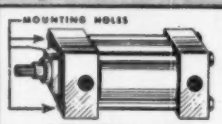
"A" Signifies Miller 200 psi Air Cylinders; "H", 2000 psi Hydraulic Cylinders. Interchangeable Mountings Are Shown In Red On Drawings.



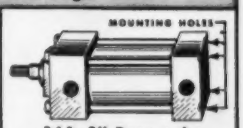
A61 and H61
Flange Mounting on Rod End
(A61 not available in 8" bore)



A62 and H62
Flange Mounting on Cap End
(A62 not available in 8" bore)



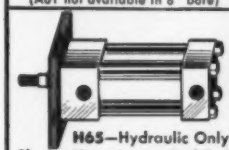
A63—8" Bore only
Flange Mounting on Rod End



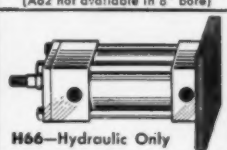
A64—8" Bore only
Flange Mounting on Cap End



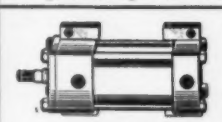
A50 & H50—Tie Rods not extended beyond nuts.
A51 & H51—Tie Rods extended both ends (shown).
A52 & H52—Tie Rods extended. Cap End only.
A53 & H53—Tie Rods Extended. Rod End only.
A54 & H54—Two Tie Rods extended at both ends.



H65—Hydraulic Only
Flange Mounting on Rod End



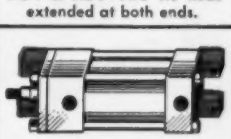
H66—Hydraulic Only
Flange Mounting on Cap End



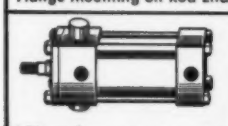
A72 and H72
Side Lug Mounting



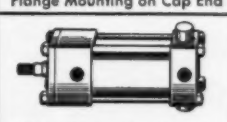
A74 and H74
Side Flush Mounting



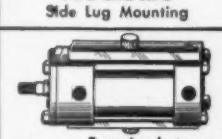
A77 and H77
Side or Foot Mounting



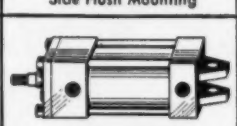
A81 and H81 Trunnion Mounting on Rod End



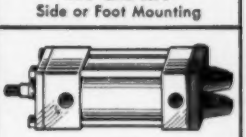
A82 and H82 Trunnion Mounting on Cap End



A83 and H83 Trunnion between Head and Cap
(one week delivery)



A84 and H84
Pivot Mounting



A86 and H86
Pivot Mounting

IN STOCK BORES in Inches — "IN-STOCK" STROKES (in Inches)

	BORES	ROD DIA.	ROD TURN DOWN & THREADS		STROKES
AIR	1½	⅝"	7/16-20	Cushioned	3 4 5 6 7 8 9 10 11 12
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12
	2	⅝"	7/16-20	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	2½	⅝"	7/16-20	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	3¼	1"	¾-16	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	4	1"	¾-16	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	5	1"	¾-16	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	6	1⅜"	1-14	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	8	1⅜"	1-14	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
HYDRAULIC	1½	⅝"	7/16-20	Cushioned	3 4 5 6 7 8 9 10 11 12
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12
	2	1"	¾-16	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	2½	1"	¾-16	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	3¼	1⅜"	1-14	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	4	1¾"	1¼-12	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	5	2"	1½-12	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36

④ ③

① "A" and "H" Models 82, 84 and 86 with strokes over 18" require stop tubes.

Column strength requires larger diameter piston rods for the following:

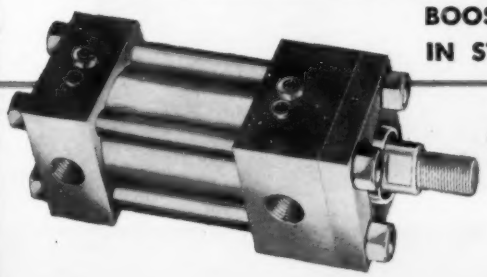
Air Cylinder Models A82, 84, and 86 with strokes inside area (1), when operated at 100 psi and over;

All hydraulic models with strokes inside area (2) and Models H82, 84, and 86 with strokes in area (4), when operated at 2000 psi and over;

Models H82, 84 and 86 with strokes inside area (3), when operated at 1000 psi and over.

Depending upon Trunnion Pin location, "A" and "H" Models 83 with standard diameter piston rods can have longer strokes than Models 82, 84 and 86.

See Miller File #251 for oversize piston rod and stop tube requirements.



BOOSTERS IN STOCK

Immediate Delivery on the following Miller 25 to 1 Ratio Boosters (80 psi air input produces 2000 psi hydraulic oil output): Model B4, 5" bore, 1" dia. ram, 6" and 12" strokes; Reciprocating Booster Model DA77-RBA8, 5" bore, 1" dia. ram, 6" stroke. Also Booster Tanks, 5" dia., 6" and 10" heights.

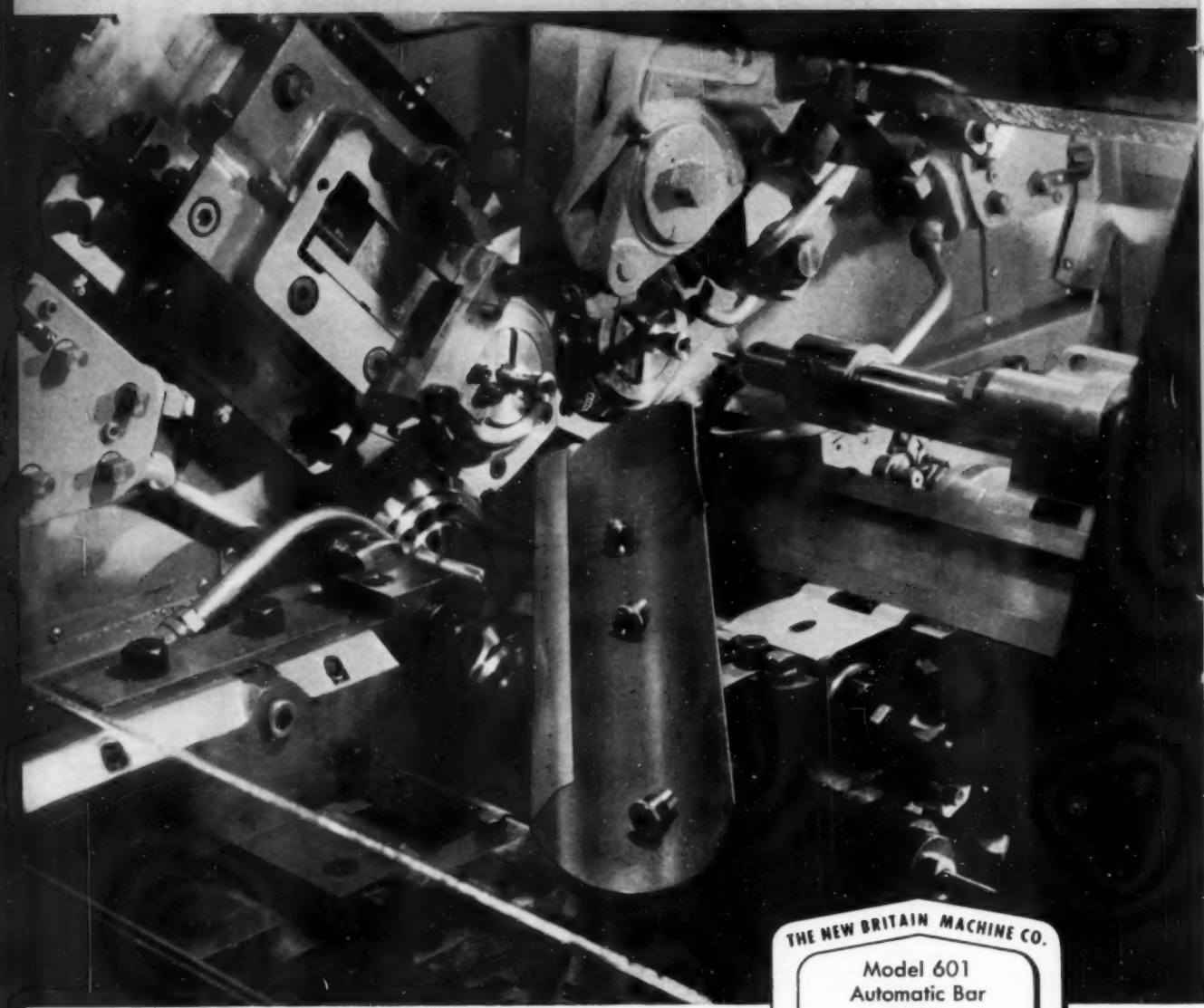
Write For Catalog and Stock Price List

Miller

MILLER FLUID POWER DIVISION
FLICK-REEDY CORP.

2010 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS



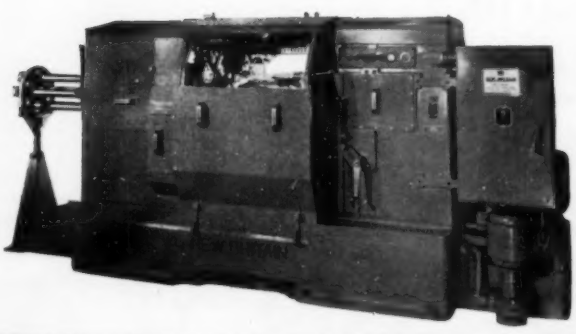
THE NEW BRITAIN MACHINE CO.

Model 601
Automatic Bar
Machine

NB

built for
the carbide age

This rugged, powerful, fast automatic has what it takes to get full mileage out of the tremendous advances in tools. Check with your New Britain man on this big cost-cutting possibility. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Another PUTNAM *first!*

STANDARD END MILLS FOR ALUMINUM





Now!

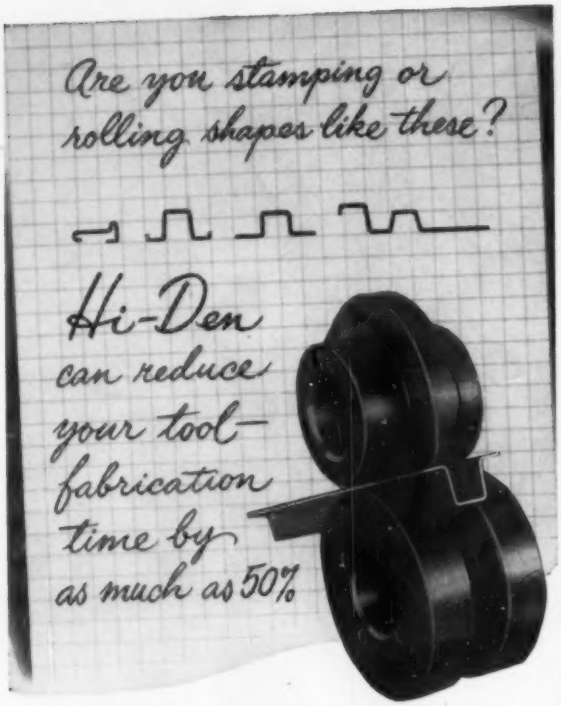
You can select a standard Putnam Hi-Speed end mill especially designed for machining aluminum and aluminum alloys.

Putnam again leads the field by making available, from stock and at standard prices, end mills for machining aluminum. These tools have been developed through years of research and experience on aluminum applications. Correct design, flutes polished all over, finest materials, and uniformity insure maximum chip removal, longer tool life, better finishes, free cutting and best all around performance.

End Mills for aluminum are offered in a range of diameters from ¼" to 2" in the three popular flute lengths. Other diameters and lengths can be furnished as required—prices on application.

Your local Putnam distributor carries over 1400 standard types and sizes of Putnam end mills—contact him for the best in service and quality end mills.

PUTNAM
TOOL COMPANY
2981 CHARLEVOIX AVENUE • DETROIT 7, MICHIGAN



A large aircraft manufacturer* reports HI-DEN rolls in a Yoder machine produced these short-run parts in stock sheared from sheet aluminum (in as-quenched condition) more satisfactorily and economically than other methods tested. And *tool fabrication time was reduced* 50%.

Another company* found that a steel draw die which formerly required three passes to complete a draw, when faced with HI-DEN completed the same draw in one pass. HI-DEN *treats the metal better.*

More than 100 different applications for HI-DEN have been reported by users . . . forming, stretch, draw and press brake dies; jigs, fixtures, templates, pressure pads and many others. Ideal for use in Hydro-form or Mar-form presses.

HI-DEN, a compreg of selected wood veneers impregnated with phenolic resin (laminated and compressed under extreme heat and pressure) is far stronger than equal weight in steel, is lighter in weight, easier to handle, resistant to oil, alcohol and moisture, dimensionally stable — and is easily shaped with standard tungsten carbide tools.

**Names on request*

If you are forming light metal parts, HI-DEN has important advantages to offer. Why not send today for Technical Bulletin and literature showing how to improve quality while lowering costs?

P.S. HI-DEN's companion product, Parkwood 8000 (a kraft paper impregnated laminate) is becoming popular for bench tops . . . smooth, hard, but resilient, it won't burr and scratch assemblies of aluminum alloy and other softer metals.

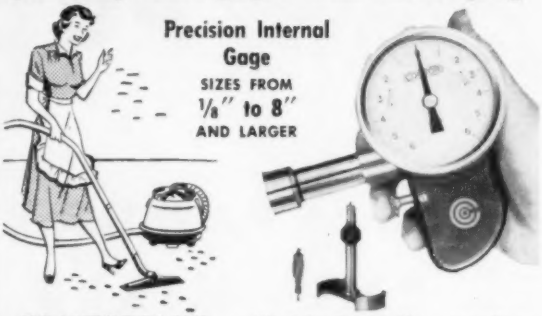
Parkwood Laminates, INC.

32 Water St., Wakefield, Massachusetts

USE READER SERVICE CARD; INDICATE A-4-272-1

Did you know that - - -

Several of your home appliances probably were gaged with Comtorplug



COMTORPLUG with interchangeable expanding plugs to gage simple or special bores from 1/8" to 8" dia.

Unique Advantages

- Positive gaging accuracy to fraction of .0001" regardless of who operates it.
- Indicates actual size, a fixed—not passing—reading.
- Positive 2-point gaging—automatic centering.
- Shallow holes, deep holes, inside splines, open-end holes gaged easily.
- Detects ovality, back or front taper, bell mouth, barrel shape.
- Reaches to bottom of blind holes.
- Gages work while still held in chuck.
- A shop tool for all-day every day use.
- Portable—no wires, hoses or stands.

Investigate the gage used by the thousands in jet engine, automotive transmission, household appliance, farm machinery, guided missile and other volume-precision plants. It MAKES PRECISION GAGING EASY . . . at machine . . . at inspection bench . . . for selective assembly. No other like it—investigate and see why.

COMTOR COMPANY
69 Farwell St.
WALTHAM 54, MASS.



GET THE FACTS—REQUEST BULLETIN 49

USE READER SERVICE CARD; INDICATE A-4-272-2

AMF Float-Lock Instant-Change Vise makes drill press COMPLETE MACHINE TOOL

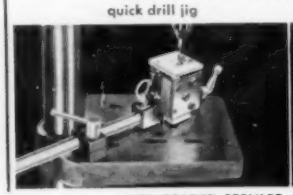


Positive anchoring . . . "Floats" and "Locks" in any position. Thumb-operated release ring permits instant change of jaw opening. Bosses on 2" centers provided on ratchet jaw for jig plates. Two models . . . 9" and 12" capacities. Special safety vise for band-saw also available. Send for complete literature now.

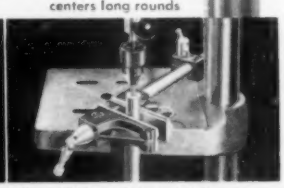
Another AMF Product
Float-Lock SAFETY VISES

AMF TOOL DIVISION
AMERICAN MACHINE & FOUNDRY COMPANY
224-A Glenwood Avenue, Bloomfield, New Jersey

quick drill jig



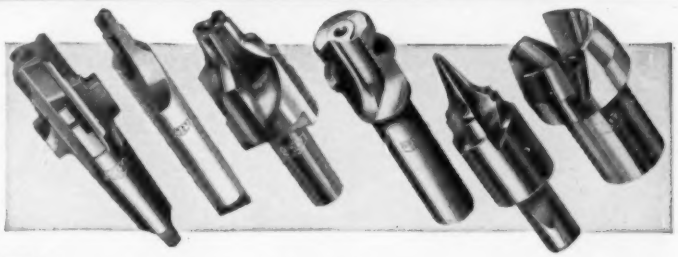
centers long rounds



USE READER SERVICE CARD; INDICATE A-4-272-3

Special Cutting Tools OF DEPENDABLE QUALITY

The Detroit Reamer & Tool Co. Plant is equipped with the finest in modern machinery and inspection facilities to provide you with the ultimate in precision tools. Our Engineering and production personnel with 35 years of empirical knowledge behind them are completely qualified to expertly handle your tool needs.



Grip-Tip CENTERS with Replaceable Carbide Tips

(PATENTED)



Grip-Tip Centers are designed to substantially reduce your replacement costs and machine downtime for regrinding or replacement of worn or chipped centers.

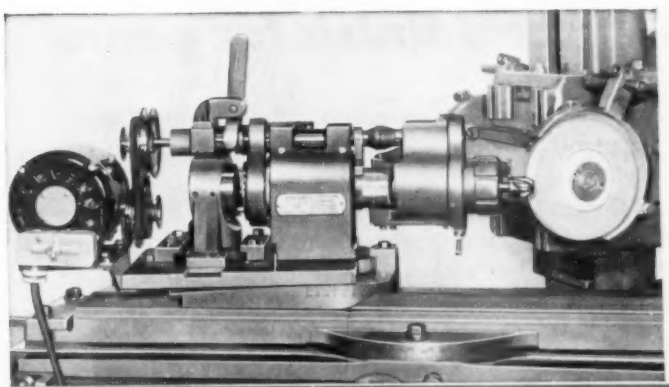
Male or female tips are inserted or removed from tool steel holders by simply turning clamping screw . . . you save replacement time.

The life of Grip-Tip holders is practically unlimited . . . only the tips are reground. Also, double end tips are relatively inexpensive . . . they reduce tool and inventory costs.

It takes but a minute to remove and replace tips . . . machine tool downtime is less with Grip-Tip.

CIRCULARITY GRINDING ATTACHMENT

(Patented)



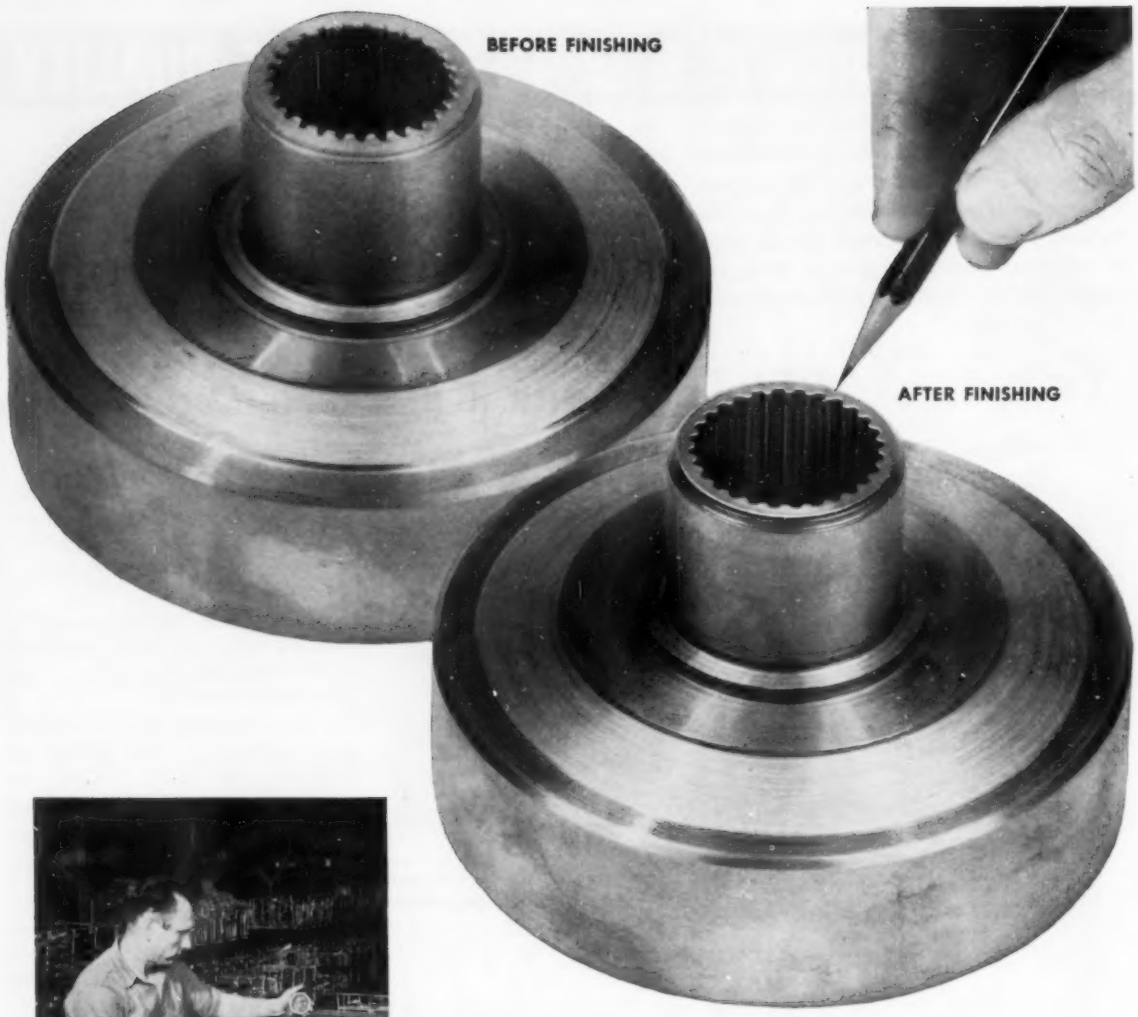
Circularity-Grinding Attachment illustrated permits your own tool makers to quickly and easily answer your production requirements for new cutting tools. With this attachment, new cutting tools can be quickly cut from raw stock, old tools converted to meet new requirements or standard tools reground to your specifications. The Circularity Grinder is of inestimable value when emergencies exist, demand for a new tool is urgent or production lines must be kept running. With this attachment in your shop you eliminate delayed deliveries.

DETROIT REAMER & TOOL CO.

780 WEST MAPLE ROAD • P.O. BOX 174 • BIRMINGHAM, MICHIGAN

DR&T COMPANY

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Osborn Brushamatic 3A removes burrs, blends and finishes surface junctures on end of spline in continuous run of 2000-2400 of these gears per day.*

5-second finish for gears

IN a major automotive plant, 5-second Brushamatic* finishing of this gear helps maintain a high daily production rate of 2000 top-quality automatic transmissions.

An **O**sborn **B**rushing **A**nalysis of your finishing operations will show how *you* can profit from Brushamatic finishing methods proved in automotive and other industries. Write *The Osborn Manufacturing Company, Dept. K-22, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

*Trade-Mark

Osborn Brushes

OSBORN

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BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

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ASTE LAPEL EMBLEM



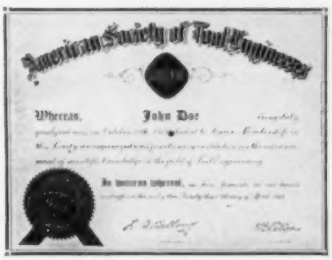
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The ASTE Lapel Emblem is a distinctive piece of jewelry as well as a means of signifying your membership in the Society.

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$1.00 each

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MASTER SPACER

with No. 0 Timken Bearings

gives increased production and optimum accuracy in



straddle milling



milling



jig drilling
with either micrometer or "Jo" block setting



inspection



Write for free catalog "Erickson Master Spacer" today. And at the same time request your copy of Catalog K; you'll find cost-slashing applications for all Erickson holding tools.



The new Erickson Master Spacer quickly and accurately positions work for a wide variety of jobs. This *one* tool can eliminate expensive jigs and fixtures . . . makes it a simple procedure to set up drilling, milling, boring and special machining operations.

The new Erickson Master Spacer, ideal for tool room and production machining, assures outstanding performance under heavy helical cuts and slow feeds. *Indexing accuracy guaranteed within .001-inch cumulative error on a 6-inch diameter circle.* Jig drilling is possible with either micrometer or "Jo" block setting. Timken bearing construction permits work to be trued in position with brake off because spindle alignment remains unchanged.

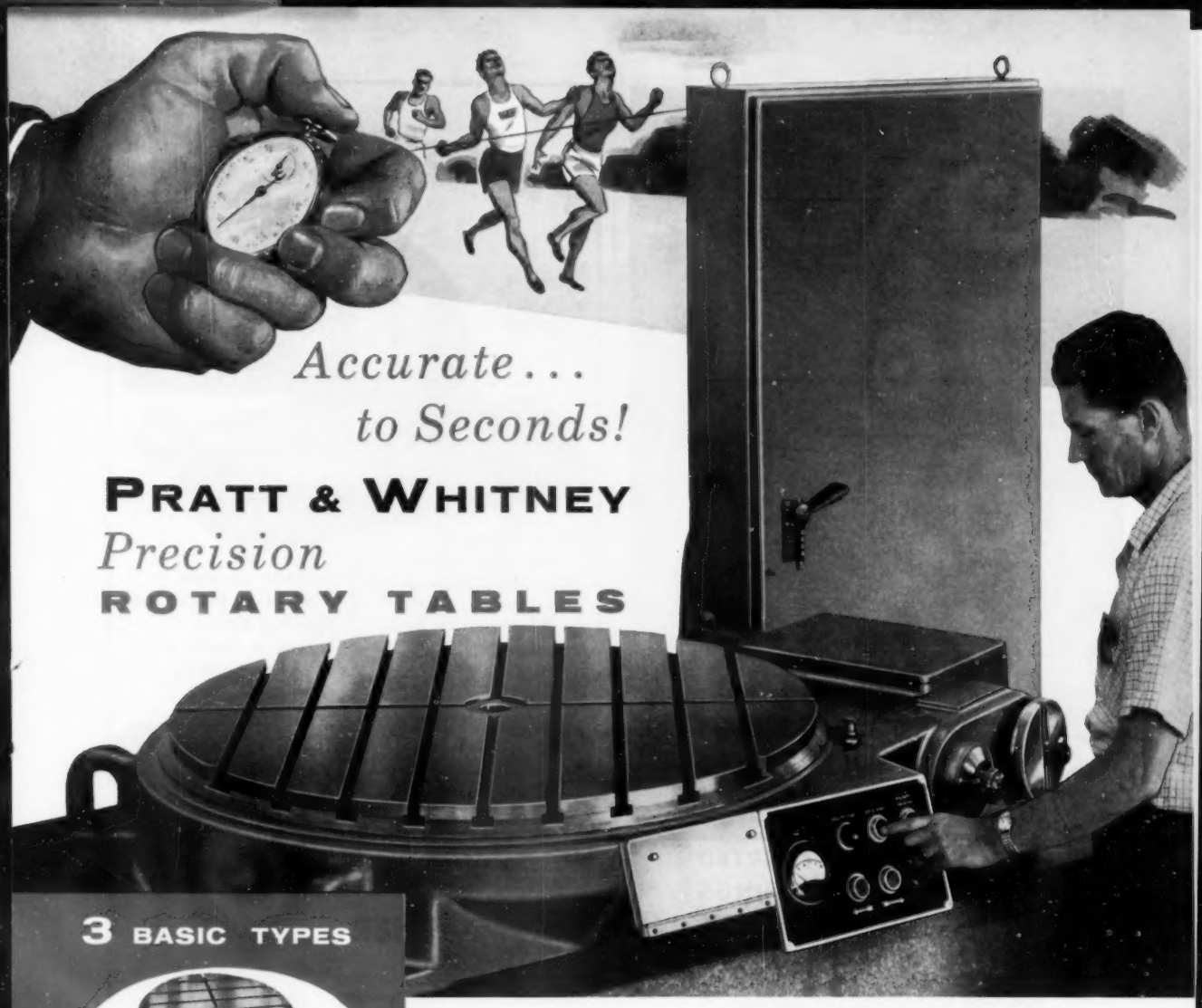
The new Erickson Master Spacer can help you come to grips with your Number One Problem—high production costs. The first step is to get the Erickson story.

AA-3091

ERICKSON TOOL COMPANY

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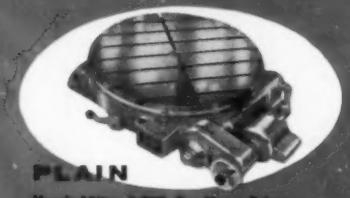
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Accurate . . .
to Seconds!

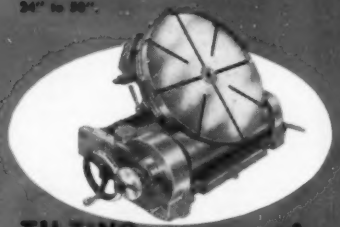
PRATT & WHITNEY
Precision
ROTARY TABLES

3 BASIC TYPES



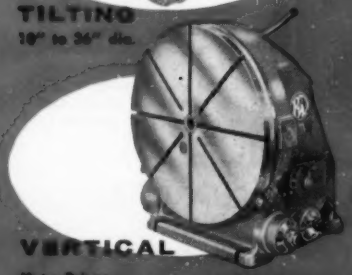
PLAIN

Hand; 12" and 20" dia. Motor-Driven 24" to 80".



TILTING

18" to 36" dia.



VERTICAL

Motor-Driven 30" and 48" dia.

Like the timer's stop watch, Pratt & Whitney Rotary Tables are *accurate to seconds* . . . seconds of arc, that is! And they're built for ruggedness and stamina too. They'll help you eliminate expensive jigs and set-up changes on difficult, precise machining jobs year after year. Ideal, too, for reliable inspection and circular indexing.

Featured here is the latest in this advanced line . . . the new 42" Plain Rotary Tables WITH AUTOMATIC INDEXING. Work is automatically positioned to any desired angle by means of easily set dogs. Initial *and* repeat settings are made with the same dependably high accuracy.

Now . . . Pratt & Whitney Rotary Tables can also be furnished with indexing control by **numerical data.**

WRITE FOR COMPLETE INFORMATION . . . ask for illustrated circulars fully describing P&W Precision Rotary Tables.

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MACHINE TOOLS • GAGES • CUTTING TOOLS

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DE-STA-CO TITAN TOGGLE CLAMPS!

(Models 557 and 558)



- THE ULTIMATE IN RUGGED CONSTRUCTION
- completely replaceable parts
- forged steel components
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- weight of 4½ pounds!



(Model 558 is the same as Model 557, but with upright handle!)

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Send for FREE Literature on these new DE-STA-CO Titans—Models 557, 558!

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PRECISION GEARS?

ROLL TEST THEM RAPIDLY ACCURATELY with the SCHERR 5" FINE PITCH GEAR TESTER



So economically priced they can be placed alongside each Gear Cutter as well as in the Inspection Dept.

COMPLETE WITH HIGH CENTER ATTACHMENT..... $425

Quickly reveals Runout in Pitch Line, Spacing Errors, Errors in Tooth Form, Running Quality Generally.

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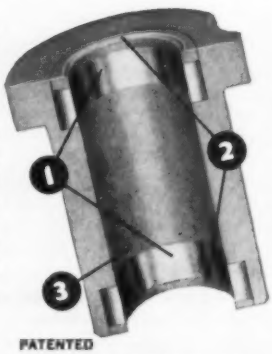
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IN Automation !

The reason is simple: these unique bushings are ideally suited for long-running, uninterrupted operations!

MEYCO carbide inserted bushings assure long life for drills, jigs, fixtures . . . accurate work maintained, resulting in less down-time, fewer lost man-hours. Last almost as long as solid carbide bushings, cost slightly more than ordinary bushings. Get the full story:

Write for information and price list, ask for Catalog No. 42



PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

EST. 1888



W. F. MEYERS CO., INC., BEDFORD, INDIANA

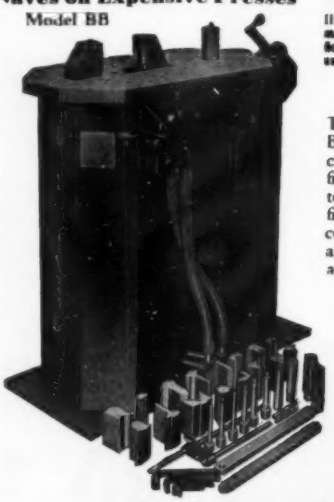
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Multiform

BIG BROTHER BENDER

Produces Without Special Tooling—Saves Die Costs Saves on Expensive Presses

Model BB





Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender, using the standard tooling.

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches—punching and blanking dies extra.

Will punch holes up to 1" and form material up to ¼" thick by 4" wide. We also build smaller hand or air operated models for forming up to ⅛"x1½" material. These machines are solving new forming problems in many plants and could be the answer to yours.

Send for illustrated folder TE-5

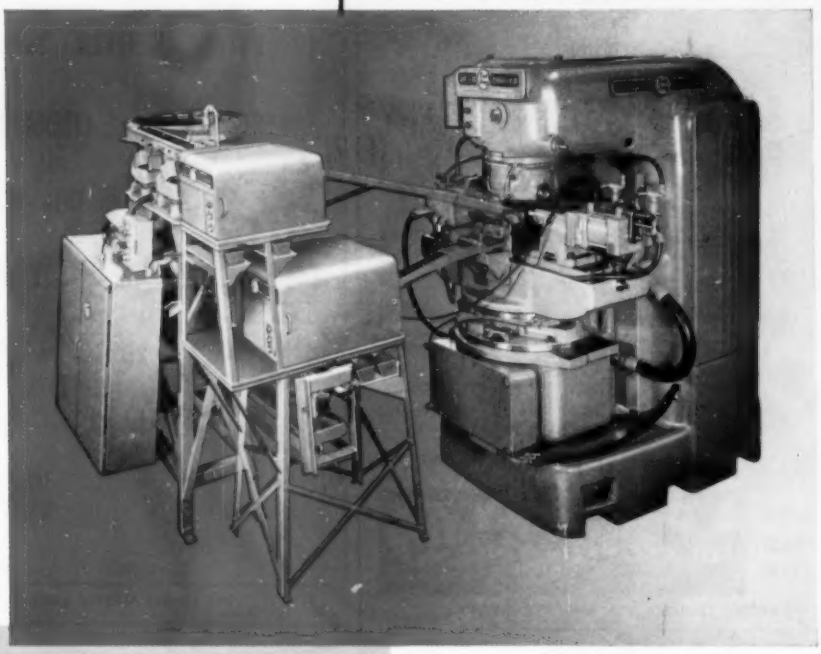
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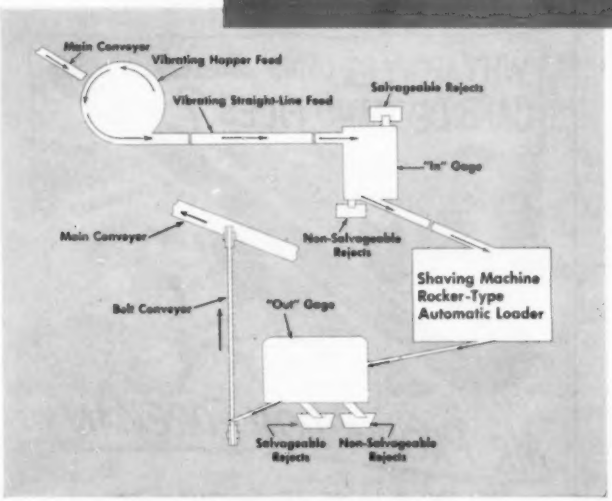
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FOR MINIMUM COSTS

SHAVE GEARS AUTOMATICALLY





This is fully automatic Red Ring gear finishing.

Cut gears come in on a conveyor to the storage and feeding mechanism. This may be a vibrating hopper, overhead chute or other device.

These gears are fed into an "In Gage" which screens out undersize and greatly oversize parts, passing only those within tolerance to the Shaving Machine.

After shaving, the gears then go through the "Out Gage" where they are checked for size and helix angle—again screening out the rejects.

Whenever the percentage of rejects goes beyond a selected amount the gage shuts down the shaving machine and indicates by signal lights the nature of the difficulty.

WRITE FOR COMPLETE DETAILS



NATIONAL BROACH & MACHINE CO.

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WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

7381

Look into the complete, cost-cutting **LOVEJOY** *line. Standard tools are* *in stock* *– to help you increase production, save time and money* *now!*



INSERTED-TOOTH MILLING CUTTERS

Face, side, end, slotting and boring mills.

H. S. S., CARBIDE, ALLOY BLADES

Interchangeable in all Type "A" milling cutters from 4½" to 24" in diameter.

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And new Type "Z" slotting cutters provide maximum axial and radial adjustment.

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Lovejoy Milling Cutter · Assembly Gage

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Write for new catalogs: No. 31 (Face Mills), No. 32 (Side Mills), No. 33 (Arbors).

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Send for free **SPEED & FEED CALCULATOR**

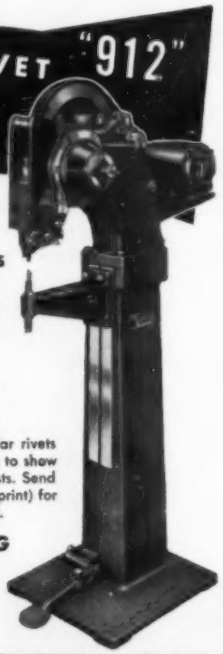
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SPRINGFIELD, VERMONT, U. S. A.

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TO OBTAIN FURTHER INFORMATION ABOUT ADVERTSERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 203.

USE READER SERVICE CARD; INDICATE A-4-280-3

Chicago **RIVET "912"**
AUTOMATIC RIVET SETTER
CUTS COSTS 3 WAYS



1 FASTENS FASTER . . . Only the speed of the operator limits the 912's riveting speed. Completely automatic. A push on the foot pedal automatically feeds, inserts and clinches the rivet.

2 DOES WORK OF SEVERAL MACHINES Quick change rotary hopper and raceway makes the 912 adjustable in 5 to 10 minutes to set different size rivets. Adjustable anvil height and 12-inch throat provide further versatility.

3 SAVES ON MAINTENANCE . . . The 912 is massively built to stand the shocks of constant use and is designed for quick, easy servicing and parts replacement.

If your assembly calls for 3/16" steel tubular rivets or smaller, of 15/16" lengths or less, ask us to show you how the 912 can cut your fastening costs. Send a sample of your problem assembly (or blueprint) for a free fastening analysis.



FREE CATALOG *contains valuable engineering information and rivet specifications plus illustrated descriptions of 26 Chicago Automatic Rivet Setters.*

Chicago Rivet **& MACHINE CO.**
9619 West Jackson Boulevard, Bellwood (Chicago Suburb) Illinois
Branch Factory: **Tyrone, Pa.**

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MR. PRODUCTION FOREMAN:

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WE'LL SEND YOU COMPLETE INFORMATION AND PRICES VIA RETURN AIR MAIL!
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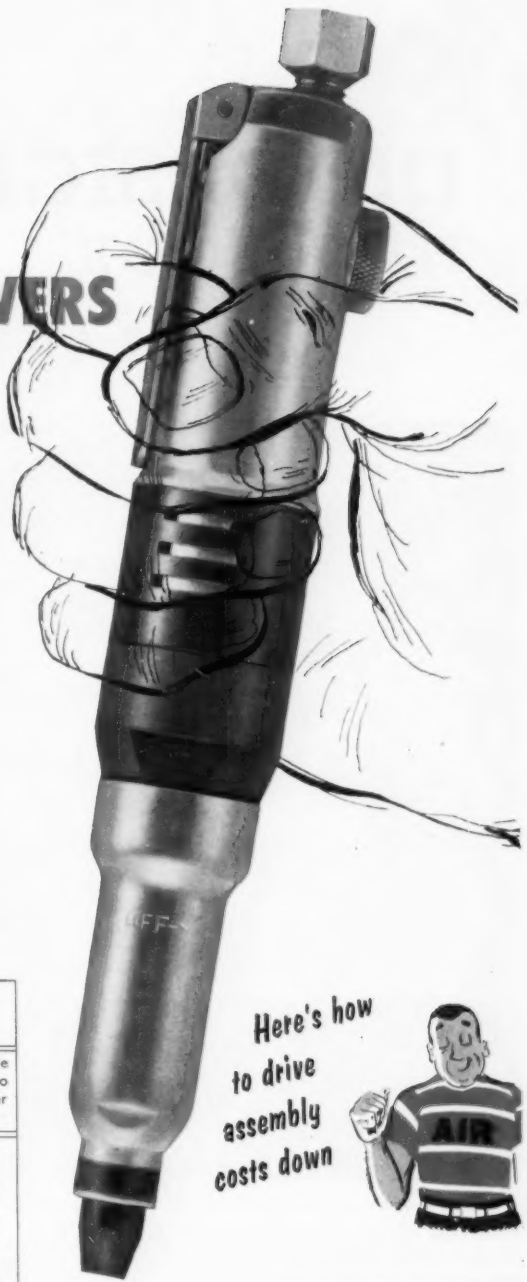
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Representatives and Distributors in principal industrial areas

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ROTOR AIR SCREW DRIVERS AND NUT SETTERS

Powerful! Light!



- Rugged . . . long-life construction
- More power per pound
- Simplified torque adjustment
- 3 types of drives
- Reversible or non-reversible motors

TYPICAL SPECIFICATIONS
Reversible* . . . Adjustable Clutch† Type

Type	Handle ¼" Air Inlet	Free Speed at 90# Pres.	CAPACITY Free Run. Screws	Bolt Size	Wt. (Lbs.)	Lgth. (Ins.)	Spindle Side to Center (In.)
S-02-PRC	Pistol	2000	#2 to #12	To ¼"	2¼	8¾	25/32
S-02-PRC	Pistol	850	#2 to #12	To ¼"	2½	9¼	25/32
S-02-PRC	Pistol	450	#2 to #12	To ¼"	2½	9¼	25/32
S-02-LRC	Lever	2000	#2 to #12	To ¼"	1⅞	10	25/32
S-02-LRC	Lever	850	#2 to #12	To ¼"	2⅛	10½	25/32
S-02-LRC	Lever	450	#2 to #12	To ¼"	2⅛	10½	25/32

*Also Non-Reversible †Also Positive Clutch and Direct Drive

Here's how to drive assembly costs down

WRITE FOR BULLETIN No. 46



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CLEVELAND, OHIO
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INCLUDES designs of stampings, every phase of process analysis, die design economics, theory of metal movements, materials, proved die designs, die setting principles and selection of presses and little-known data on non-metal die designs.

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IMPACT RESISTANT PLASTIC TOOLING

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Thiokol Chemical Corporation manufactures Thiokol Liquid Polymer only as a raw material. We are happy to indicate sources of suitable compounds for end use.

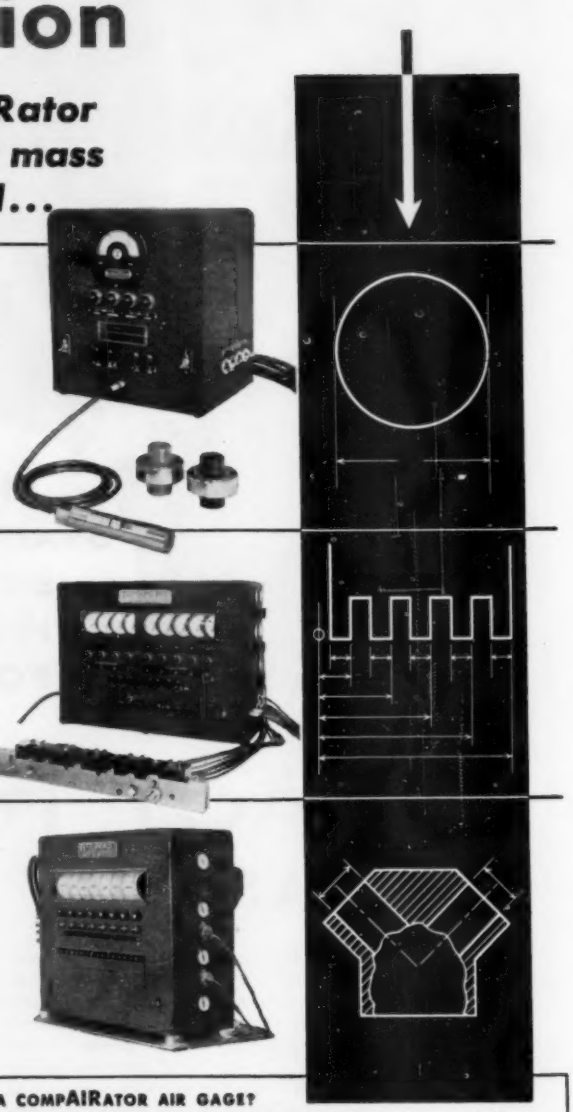
Thiokol®

PIONEER MANUFACTURERS OF SYNTHETIC RUBBER

NUMBER FOUR IN A SERIES

Air Gaging for Automation

Some Taft-Peirce CompAIRator Air Gage Installations for mass production quality control...



Size Control on Automatic Lathe

This T-P Air-Electric CompAIRator is attached to an automatic lathe. As parts approach tolerance limits, gaging unit sends an electrical impulse to machine, which advances or retracts cutting tool to keep parts in optimum size range. If a part is produced outside the tolerance limits, unit shuts down the machine.

Size Control at Milling Machine

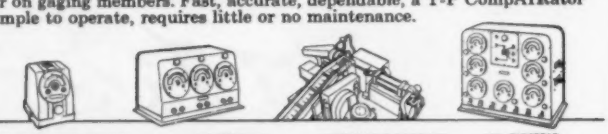
This T-P Air-Electric CompAIRator checks locations and widths of the main bearings of automotive cylinder blocks. 9 dials and lights indicate 5 bearing locations and 4 widths simultaneously. When any location or width is out of tolerance, unit automatically stops milling machine. Light indicates off-size dimension, dial reports exact size.

Size Control in Transfer Machine

This T-P Air-Electric CompAIRator checks 8 cylinder bore diameters simultaneously in V-8 automotive engine blocks. Automatically gages the diameter of the entire length of each bore. If any bore is out of tolerance, a light points it out, and production line is automatically shut down at completion of gaging cycle. Tolerance: .002".

WHAT IS A COMPAIRATOR AIR GAGE?

A CompAIRator is a sensitive gaging instrument that measures variations in the velocity of tiny jets of air. When work is placed over these jets, air flow is restricted and its velocity reduced. Any change in air velocity reflects a change in part size, which is immediately shown on a calibrated indicator. Since only air contacts the part in most cases, there is minimum wear on gaging members. Fast, accurate, dependable, a T-P CompAIRator is simple to operate, requires little or no maintenance.



STANDARD AND SPECIAL COMPAIRATORS | COMPUTING COMPAIRATORS | AUTOMATIC SORTING MACHINE | AIR ELECTRIC COMPAIRATORS

T-P means Top Precision

T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND



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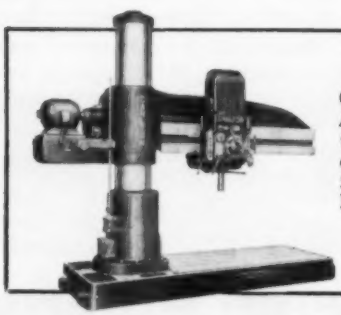
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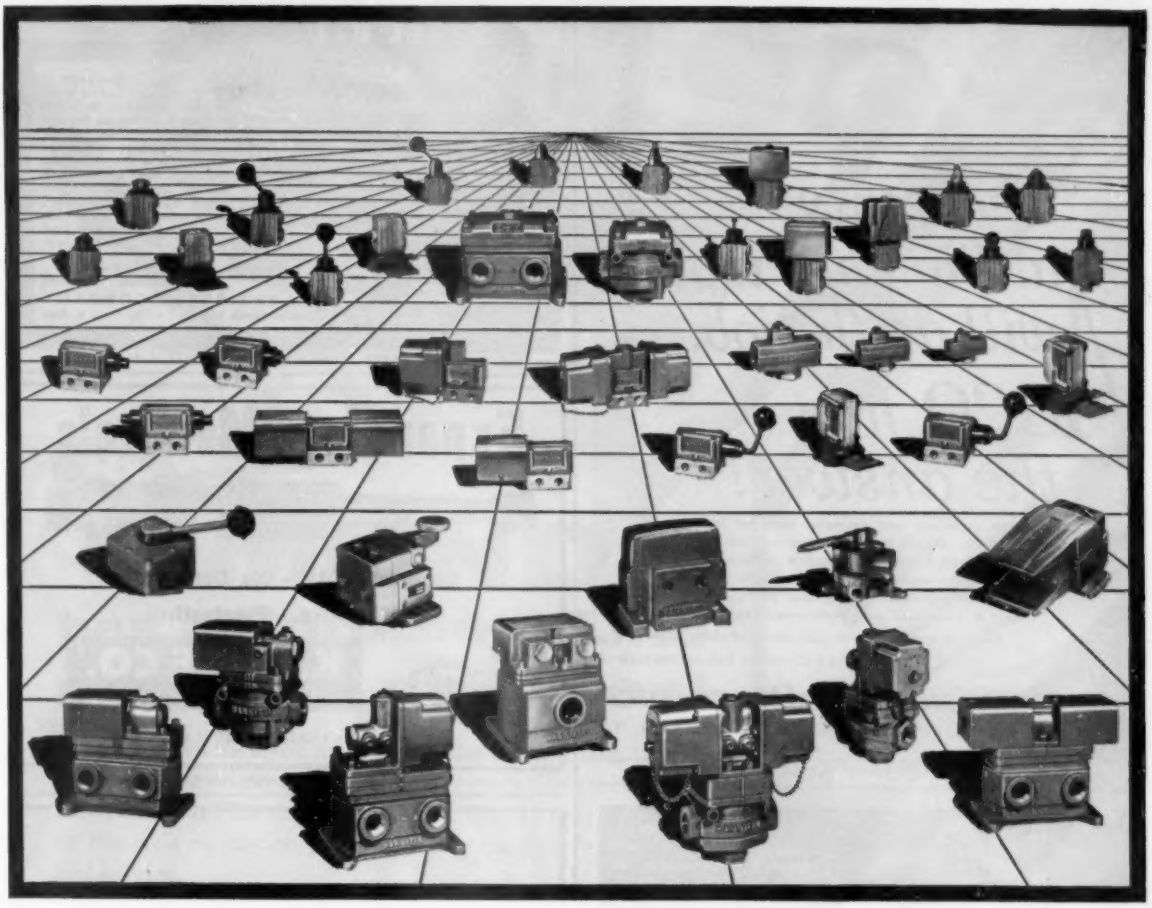
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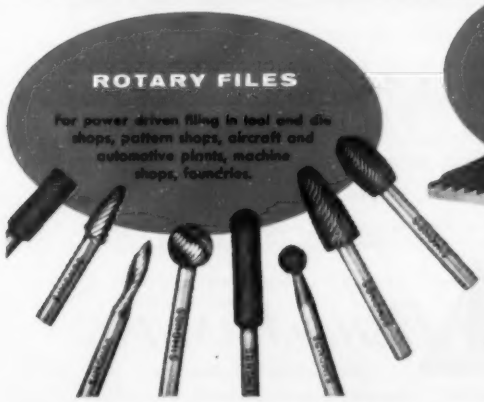
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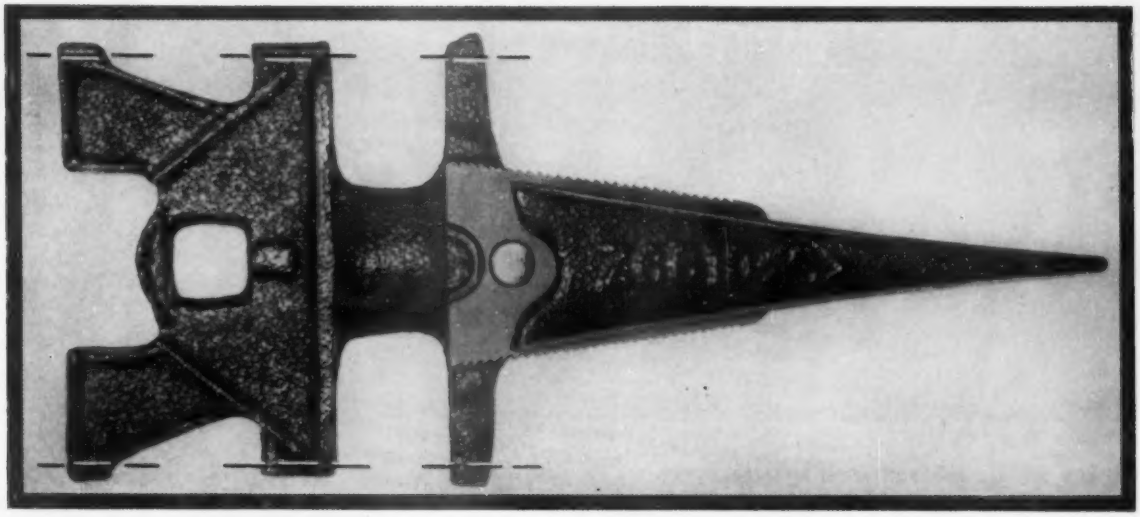
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AN OPEN INVITATION TO AUTHORS

An invitation for technical papers has been extended by the National Program Committee of the American Society of Tool Engineers. The papers are for presentation at the 25th (Silver Anniversary) Annual Convention of the ASTE, being held in April 1957.

ASTE membership is not required for submission of a paper. Additional papers will be accepted for consideration until May 1, 1956. Each proposal should include an outline of the paper, the author's name, title and affiliation.

Authors must also agree to abide by the published rules for presentation of papers before a national meeting of the ASTE.

Outlines should be sent to:

L. S. Fletcher
Program Director
American Society of Tool Engineers
10700 Puritan Avenue
Detroit 38, Michigan

Authors of accepted papers will be notified by June 15, 1956.

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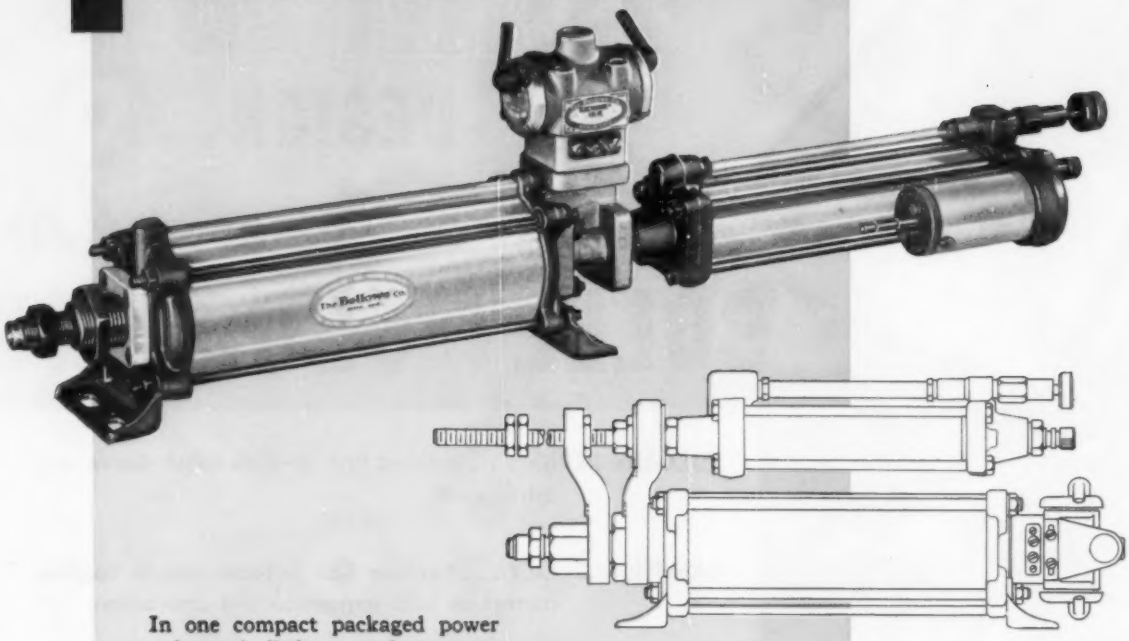
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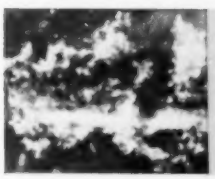
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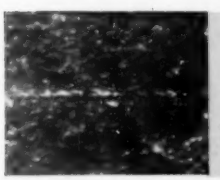
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April 1956 Issue

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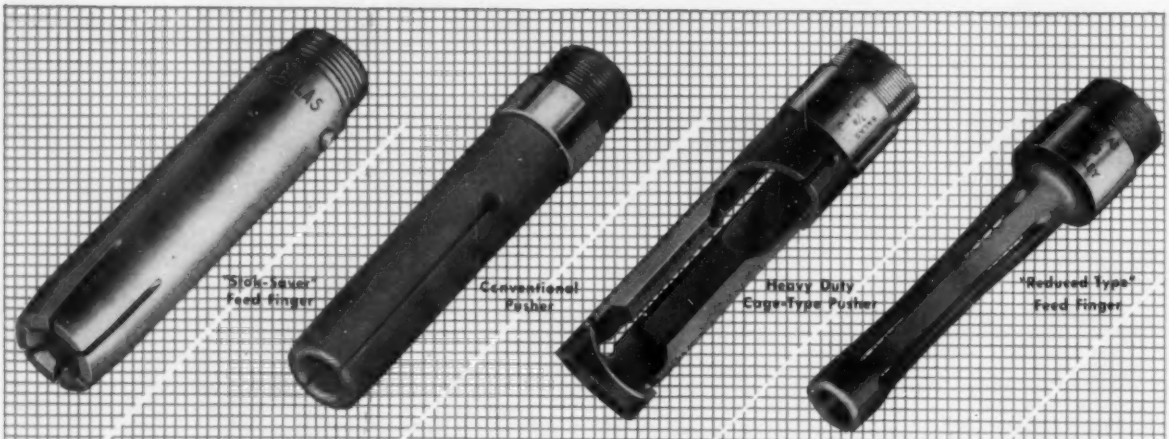
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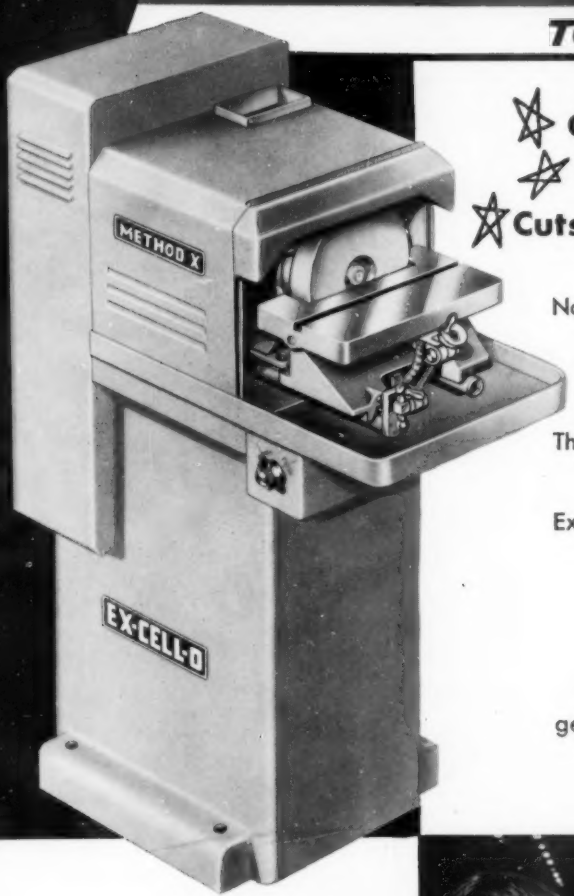
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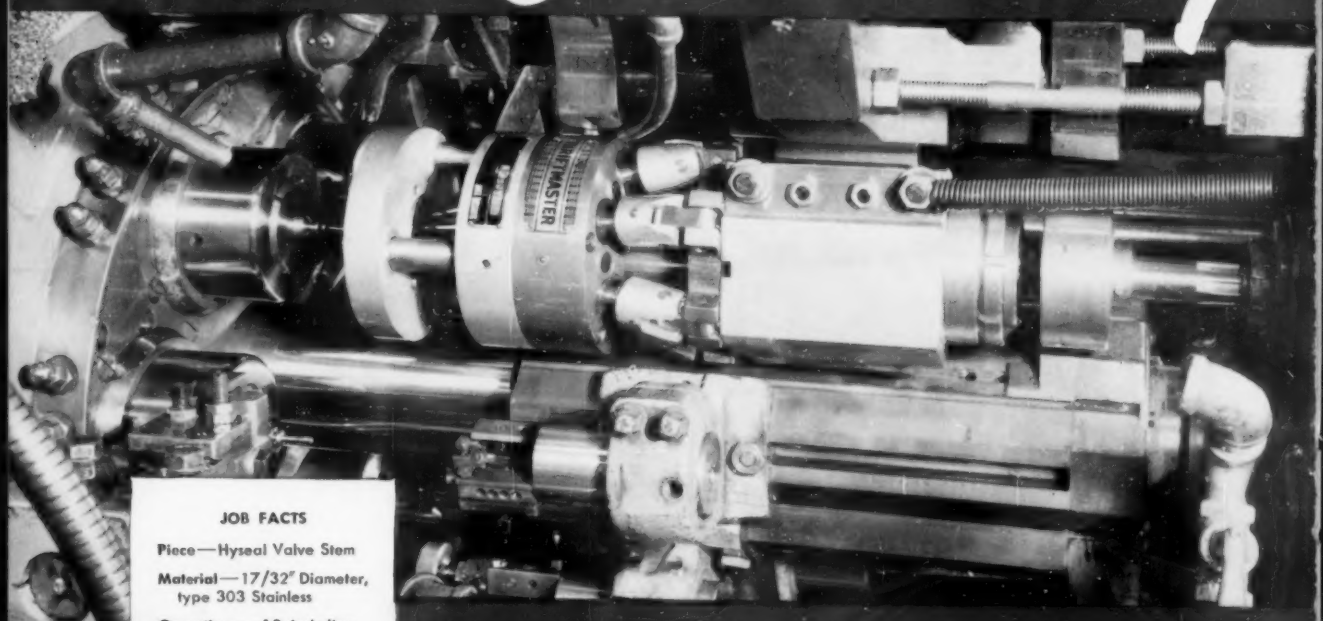
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